ALBERT R. MANN
LIBRARY
AT
CORNELL UNIVERSITY

DATE DUE

DEMCO 38-297

CORNELL UNIVERSITY LIBRARY

3 1924 055 254 001

MYCOTAXON

AN INTERNATIONAL JOURNAL DESIGNED TO EXPEDITE PUBLICATION OF RESEARCH ON TAXONOMY & NOMENCLATURE OF FUNGI & LICHENS

Volume XXX October-December 1987

CONTENTS

A new species of *Thaxteriola* associated with mites in Australia.
J. A. SIMPSON AND C. STONE 1
Coprophilous fungi from Spain VII. *Faurelina hispanica* sp. nov.
M. VALLDOSERA, J. GUARRO, AND M. J. FIGUERAS 5
Taxonomic studies in the genera *Protounguicularia, Arachnopeziza* and *Dematioscypha* . . . . SEPPO HUHTINEN 9
Notes on hyphomycetes. LIV. Concerning *Pithomyces clavisporus,* a new species, *P. graminicola* and *P. pavgii* . . . . GARETH MORGAN-JONES 29
The taxa of *Usnea* (Lichenes) described by Michaux from eastern North America.
ISABELLE I. TAVARES 39
New or interesting Greenland lichens IV . . ERIC STEEN HANSEN AND JOSEF POELT 69
Xylaria corniformis reconsidered . . . . THOMAS LÆSSØE 81
Endophyte-host associations in forage grasses. X. Cultural studies on some species of *Acremonium* sect. *Albo-lanosa,* including a new species, *A. starrii.*
J. F. WHITE, JR. AND GARETH MORGAN-JONES 87
Asteromidium tabebuiae sp. nov. from Brazil.
F. A. FERREIRA AND J. J. MUCHOVEJ 97
On the nomenclature of the European species of the *Armillaria mellea* group.
AAD TERMORSHUIZEN AND EEF ARNOLDS 101
Notes on coelomycetes. II. Concerning the *Fusicoccum* anamorph of *Botryosphaeria ribis* . . . . GARETH MORGAN-JONES AND J. F. WHITE, JR. 117
Vaccinium fungi: *Corynespora arctespora,* comb. nov. . . . . L. M. CARRIS 127
Peronospora on two *Cerastium* species in northern Europe . . . ARNE GUSTAVSSON 133
A new name for *Phialocephala illini* . . . . MICHAEL J. WINGFIELD 149
New records of *Lactarius* in Mexico.
GONZALO GUEVARA G., JÉSUS GARCÍA J., JOSÉ CASTILLO T., AND ORSON K. MILLER, JR. 157
Notes on coelomycetes. III. Concerning *Microsphaeropsis concentrica:* morphology and ultrastructure. . GARETH MORGAN-JONES AND J. F. WHITE, JR. 177
Xeromedulla, a new genus of foliicolous discomycetes (Leotiaceae).
WEN-YING ZHUANG AND RICHARD P. KORF 189
A new species of *Uromyces* on *Atylosia* from India.
G. BAGYANARAYANA, P. RAMACHAR, AND K. NIRANJAN RAO 193
Corticolous myxomycetes from Cyprus . . . . B. ING 195
Myxomycetes from Thailand – II . . . . . B. ING, J. SIWASIN, AND S. SAMARNPAN 197

[CONTENTS continued overleaf]

ISSN 0093-4666 MYXNAE 30 1-531 (1987)

Published quarterly by MYCOTAXON, LTD., P.O. Box 264, Ithaca, NY 14851
For subscription details, availability in microfilm and microfiche,
and availability of articles as tear sheets, see back cover

[CONTENTS continued from front cover]

Myxomycetes from Hong Kong and southern China . . . . BRUCE ING 199

Cultural studies in *Fibricium* (Corticiaceae, Basidiomycetes).
NILS HALLENBERG AND ANNAROSA BERNICCHIA 203

Taxonomie et nomenclature de *Diatrype stigma, D. decorticata* et *D. undulata* (Diatrypaceae, Ascomycetes) . . . . FRANÇOIS RAPPAZ 209

The known species of *Phaeocollybia* (Agaricales, Cortinariaceae) in Mexico.
GASTÓN GUZMÁN, VICTOR M. BANDALA-MUÑOZ, AND LETICIA MONTOYA-BELLO 221

Studies in the genus *Phoma*. IX. Concerning *Phoma jolyana*.
GARETH MORGAN-JONES AND KATHERINE B. BURCH 239

Dissitimurus, a new dematiaceous genus of hyphomycetes.
EMORY G. SIMMONS, MICHAEL R. MCGINNIS, AND MICHAEL G. RINALDI 247

Taxonomic concepts in the Endogonaceae: IV. *Glomus fasciculatum* redescribed.
CHRISTOPHER WALKER AND R. E. KOSKE 253

New hyphomycetes from Santiago River. II. (Buenos Aires Province, Argentina).
ANGÉLICA ARAMBARRI, MARTA CABELLO, AND ADRIANA MENGASCINI 263

Fungi of the Appalachian Mountains.
OSWALD HILBER, RUZENA HILBER, AND ORSON K. MILLER, JR. 269

Massariella: a debated genus . . . . A. MONTEMARTINI CORTE 289

Recherches sur *Hebeloma* (Agaricales, Cortinariaceae). I. Quelques notes taxonomiques et nomenclaturales . . . . LIVIO QUADRACCIA 301

New or interesting species of *Xanthoparmelia* (Vanio) Hale (Ascomycotina: Parmeliaceae) . . . . MASON E. HALE 319

A new species of *Flavoparmelia* and *Flavopunctelia* (lichenized Ascomycotina) from Argentina . . . . JOHN A. ELIX AND MÓNICA T. ADLER 335

Three new saxicolous species in Parmeliaceae (lichenized Ascomycotina) from Argentina . . . . MÓNICA T. ADLER AND JOHN A. ELIX 339

Notes on hyphomycetes. LV. *Craneomyces* gen. nov. and *Trichobotrys effusa*.
GARETH MORGAN-JONES, ROBERT C. SINCLAIR, AND ALBERT EICKER 345

Notes on hyphomycetes. LVI. *Ceratosporella cheiroidea,* a new species.
ROBERT C. SINCLAIR, ALBERT EICKER, AND GARETH MORGAN-JONES 351

The *Xerula (Collybia, Oudemansiella) radicata* complex in Canada.
S. A. REDHEAD, J. GINNS, AND R. A. SHOEMAKER 357

A new species and a new combination in *Cercophora*.
RICHARD T. HANLIN AND OMAR TORTOLERO 407

Pseudaleuria quinaultiana, a new genus and species of operculate ascomycete from the Olympic Peninsula . . . . DEMARIS E. LUSK 417

A new species of *Aleurodiscus* from Colorado . . . . J. PAGE LINDSEY 433

Species diversity of aquatic hyphomycetes in four Austrian streams.
BARBARA REGELSBERGER, KURT MESSNER, AND ENRIQUE DESCALS 439

A new species of *Comatricha* from Colorado . . . . M. L. FARR 455

A new species of the genus *Subulispora* . . A. NAWAWI AND A. J. KUTHUBUTHEEN 459

Two new species of the genus *Wynnea* from China with a key to known species.
BO LIU, JIN-ZHONG CAO, AND MEI-HUA LIU 465

A taxonomic revision of the genus *Marcelleina* . . . . JIŘÍ MORAVEC 473

Leptographium wageneri var. *pseudotsugae,* var. nov., cause of black stain root disease on Douglas-fir . . . . T. C. HARRINGTON AND F. W. COBB, JR. 501

NOTICE: International Mycological Association report of business meeting held during the XIV International Botanical Congress, Berlin, 25 July 1987 509

NOTICE: X Congress of the International Society for Human and Animal Mycology 513

[CONTENTS continued inside back cover]

MYCOTAXON

AN INTERNATIONAL JOURNAL DESIGNED TO EXPEDITE PUBLICATION
OF RESEARCH ON TAXONOMY & NOMENCLATURE OF FUNGI & LICHENS

VOLUME XXX, 1987

COMPLETE IN ONE QUARTERLY ISSUE

CONSISTING OF IV + 531 PAGES

INCLUDING FIGURES

CO-EDITORS

G. L. HENNEBERT
French Language Editor & Book Review Editor
Laboratoire de Mycologie systématique et appliquée
Université de Louvain, B-1348 Louvain-la-Neuve, Belgium

RICHARD P. KORF
English Language Editor & Managing Editor
Mycotaxon, Ltd., P.O. Box 264
Ithaca, NY 14851, USA

SUSAN C. GRUFF
Associate Editor & Index Editor
Plant Pathology Herbarium, Cornell University
Ithaca, NY 14853, USA

QK
600
M992
v.30
1987

Published by

MYCOTAXON, LTD., P.O. BOX 264
ITHACA, NY 14851, USA

Printed in the United States of America

TABLE OF CONTENTS, VOLUME THIRTY

October-December 1987

A new species of *Thaxteriola* associated with mites in Australia.
J. A. SIMPSON AND C. STONE 1
Coprophilous fungi from Spain VII. *Faurelina hispanica* sp. nov.
M. VALLDOSERA, J. GUARRO, AND M. J. FIGUERAS 5
Taxonomic studies in the genera *Protounguicularia, Arachnopeziza* and *Dematioscypha* .... SEPPO HUHTINEN 9
Notes on hyphomycetes. LIV. Concerning *Pithomyces clavisporus,* a new species, *P. graminicola* and *P. pavgii* .... GARETH MORGAN-JONES 29
The taxa of *Usnea* (Lichenes) described by Michaux from eastern North America.
ISABELLE I. TAVARES 39
New or interesting Greenland lichens IV ... ERIC STEEN HANSEN & JOSEF POELT 69
Xylaria corniformis reconsidered .... THOMAS LÆSSØE 81
Endophyte-host associations in forage grasses. X. Cultural studies on some species of *Acremonium* sect. *Albo-lanosa,* including a new species, *A. starrii.*
J. F. WHITE, JR. AND GARETH MORGAN-JONES 87
Asteromidium tabebuiae sp. nov. from Brazil.
F. A. FERREIRA AND J. J. MUCHOVEJ 97
On the nomenclature of the European species of the *Armillaria mellea* group.
AAD TERMORSHUIZEN AND EEF ARNOLDS 101
Notes on coelomycetes. II. Concerning the *Fusicoccum* anamorph of *Botryosphaeria ribis* .... GARETH MORGAN-JONES AND J. F. WHITE, JR. 117
Vaccinium fungi: *Corynespora arctespora,* comb. nov. .... L. M. CARRIS 127
Peronospora on two *Cerastium* species in northern Europe ... ARNE GUSTAVSSON 133
A new name for *Phialocephala illini* .... MICHAEL J. WINGFIELD 149
New records of *Lactarius* in Mexico.
GONZALO GUEVARA G., JÉSUS GARCÍA J., JOSÉ CASTILLO T., AND ORSON K. MILLER, JR. 157
Notes on coelomycetes. III. Concerning *Microsphaeropsis concentrica:* morphology and ultrastructure. . GARETH MORGAN-JONES AND J. F. WHITE, JR. 177
Xeromedulla, a new genus of foliicolous discomycetes (Leotiaceae).
WEN-YING ZHUANG AND RICHARD P. KORF 189
A new species of *Uromyces* on *Atylosia* from India.
G. BAGYANARAYANA, P. RAMACHAR, AND K. NIRANJAN RAO 193
Corticolous myxomycetes from Cyprus .... B. ING 195
Myxomycetes from Thailand – II ...... B. ING, J. SIWASIN, AND S. SAMARNPAN 197
Myxomycetes from Hong Kong and southern China .... BRUCE ING 199
Cultural studies in *Fibricium* (Corticiaceae, Basidiomycetes).
NILS HALLENBERG AND ANNAROSA BERNICCHIA 203
Taxonomie et nomenclature de *Diatrype stigma, D. decorticata* et *D. undulata* (Diatrypaceae, Ascomycetes) .... FRANÇOIS RAPPAZ 209
The known species of *Phaeocollybia* (Agaricales, Cortinariaceae) in Mexico.
GASTÓN GUZMÁN, VICTOR M. BANDALA-MUÑOZ, AND LETICIA MONTOYA-BELLO 221
Studies in the genus *Phoma.* IX. Concerning *Phoma jolyana.*
GARETH MORGAN-JONES AND KATHERINE B. BURCH 239
Dissitimurus, a new dematiaceous genus of hyphomycetes.
EMORY G. SIMMONS, MICHAEL R. MCGINNIS, AND MICHAEL G. RINALDI 247
Taxonomic concepts in the Endogonaceae: IV. *Glomus fasciculatum* redescribed.
CHRISTOPHER WALKER AND R. E. KOSKE 253
New hyphomycetes from Santiago River. II. (Buenos Aires Province, Argentina).
ANGÉLICA ARAMBARRI, MARTA CABELLO, AND ADRIANA MENGASCINI 263

Fungi of the Appalachian Mountains.
OSWALD HILBER, RUZENA HILBER, AND ORSON K. MILLER, JR. 269
Massariella: a debated genus .... A. MONTEMARTINI CORTE 289
Recherches sur *Hebeloma* (Agaricales, Cortinariaceae). I. Quelques notes taxonomiques et nomenclaturales .... LIVIO QUADRACCIA 301
New or interesting species of *Xanthoparmelia* (Vanio) Hale (Ascomycotina: Parmeliaceae) .... MASON E. HALE 319
A new species of *Flavoparmelia* and *Flavopunctelia* (lichenized Ascomycotina) from Argentina .... JOHN A. ELIX AND MÓNICA T. ADLER 335
Three new saxicolous species in Parmeliaceae (lichenized Ascomycotina) from Argentina .... MÓNICA T. ADLER AND JOHN A. ELIX 339
Notes on hyphomycetes. LV. *Craneomyces* gen. nov. and *Trichobotrys effusa.*
GARETH MORGAN-JONES, ROBERT C. SINCLAIR, AND ALBERT EICKER 345
Notes on hyphomycetes. LVI. *Ceratosporella cheiroidea,* a new species.
ROBERT C. SINCLAIR, ALBERT EICKER, AND GARETH MORGAN-JONES 351
The *Xerula (Collybia, Oudemansiella) radicata* complex in Canada.
S. A. REDHEAD, J. GINNS, AND R. A. SHOEMAKER 357
A new species and a new combination in *Cercophora.*
RICHARD T. HANLIN AND OMAR TORTOLERO 407
Pseudaleuria quinaultiana, a new genus and species of operculate ascomycete from the Olympic Peninsula .... DEMARIS E. LUSK 417
A new species of *Aleurodiscus* from Colorado .... J. PAGE LINDSEY 433
Species diversity of aquatic hyphomycetes in four Austrian streams.
BARBARA REGELSBERGER, KURT MESSNER, AND ENRIQUE DESCALS 439
A new species of *Comatricha* from Colorado .... M. L. FARR 455
A new species of the genus *Subulispora* .. A. NAWAWI AND A. J. KUTHUBUTHEEN 459
Two new species of the genus *Wynnea* from China with a key to known species.
BO LIU, JIN-ZHONG CAO, AND MEI-HUA LIU 465
A taxonomic revision of the genus *Marcelleina* .... JIŘÍ MORAVEC 473
Leptographium wageneri var. *pseudotsugae,* var. nov., cause of black stain root disease on Douglas-fir .... T. C. HARRINGTON AND F. W. COBB, JR. 501
NOTICE: International Mycological Association report of business meeting held during the XIV International Botanical Congress, Berlin, 25 July 1987 509
NOTICE: X Congress of the International Society for Human and Animal Mycology 513

Author INDEX 515
INDEX to Fungous and Lichen Taxa 519
Reviewers 530
Publication date, MYCOTAXON Volume 29 530
Errata 531

MYCOTAXON

Vol. XXX, pp. 1-4 October-December 1987

A NEW SPECIES OF THAXTERIOLA ASSOCIATED WITH MITES IN AUSTRALIA

J.A. SIMPSON AND C. STONE

Wood Technology and Forest Research Division,
Forestry Commission of New South Wales,
P.O. Box 100, Beecroft, N.S.W., Australia 2119

Many species of *Pinus* have been introduced to Australia since European colonisation began in 1788 and three species are now widely planted in forest plantations namely *P. radiata* D. Don, *P. taeda* L. and *P. elliottii* Engelm. In 1943 the pine bark beetle *Ips grandicollis* Eichhoff was inadvertantly introduced to Australia from North America and is now a significant pest.

In the course of a study of the fungi associated with galleries of *I. grandicollis* in logs of species of *Pinus* in New South Wales, Australia, a species of *Thaxteriola* Speg. was observed on an undescribed species of the mite genus *Proctolaelaps* Berlese (Mesostigmata: Ascidae). Species of *Proctolaelaps* and other mite genera are common associates of bark beetles overseas (McGraw & Farrier, 1969; Moser & Roton, 1971) and in Australia (Womersley, 1956; Karg, 1985). The *Proctolaelaps* sp. on which the *Thaxteriola* has been found is thought to be an indigenous Australian species which has adapted to the niche provided by *I. grandicollis*. It is now a common mite associate of *I. grandicollis* in New South Wales.

Thaxteriola thalli were observed on female mites, on either or both the dorsal and sternal shields, and on leg 1 of a protonymph. Thalli were not observed on any of the other species of mites we have found in *I. grandicollis* galleries.

To collect beetles and mites, billets were cut from infested logs, returned to the laboratory, and the outer bark removed. Mites were removed from galleries or beetles, cleared in Essig's Solution, and permanently mounted in Hoyer's Medium.

Thaxteriola acarinophila J.A. Simpson and C. Stone sp. nov.

Thallus 31-43 x 4.6-6 um, fusiformis, 3-cellularis, hyalinus, laevis. Cellula basalis thallo toto circa triplo brevior, haptero 3.8-4.2 x 2.5-3.2 um, laterali, in medio vel parum infra, fusco, desuper elliptico. Septum inter duo cellulas apicales concavum, tenue. Cellula apicalis phialis, a thallo non distincta, terminalis, determinata, lageniformis, rostro brevi, 5-6 um longo, auguste cylindrico. Phialoconidia 1.0 x 1.2 um, hyalina, subglobosa.

Hab. *Proctolaelaps* in ligno Pini a *Ips grandicollis* infecta.

Holotypus : DAR 57151, C. Stone No. 201, Whiporie State Forest, N.S.W., Australia, 20 May 1986.

Thallus spindle-shaped, of three cells (Fig. 1), sometimes with a slight constriction between the mid and basal cells (Fig. 2), hyaline, smooth walled, 31-43 x 4.6-6.5 um. Basal cell about one-third of total length of thallus, with a holdfast about midway along one side. Holdfast dark-brown, oval, 3.8-4.2 x 2.5-3.2 um, with the wall 0.8-1.0 um thick (Fig. 3). Septum between the two apical cells concave, thin. Apical cell an integrated, terminal, determinate, lageniform phialide with neck 5-6 um long. Phialoconidia hyaline, subglobose, 1.0-1.2 um.

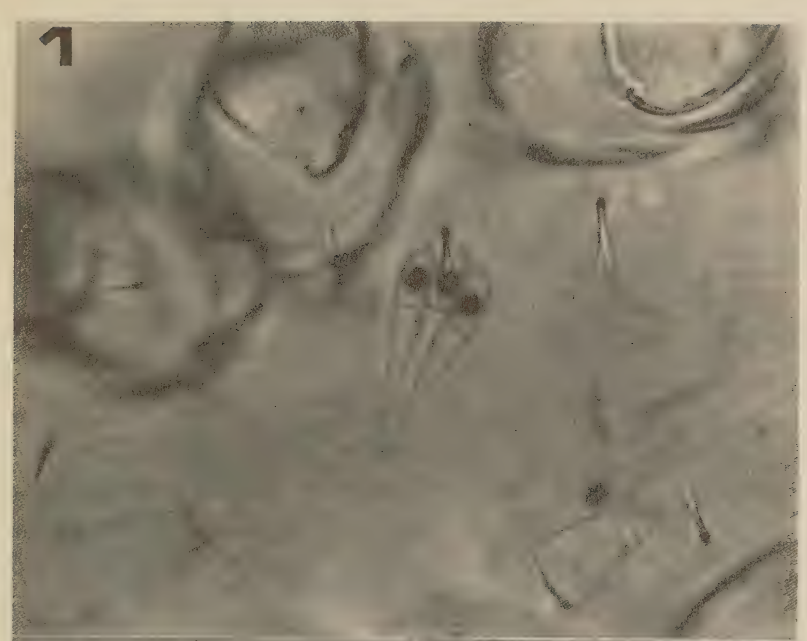
Holotype: DAR 57151, on female *Proctolaelaps* sp. in galleries of *Ips grandicollis* in *Pinus elliottii*, Whiporie State Forest, N.S.W., Australia, C. Stone No. 201, 20th May, 1986.

Other specimens examined: DAR 57153, on female *Proctolaelaps* sp. in galleries of *I. grandicollis* in *P. elliottii*, Mt. Mitchell State Forest, N.S.W., Australia, C. Stone No. 203, 20th May, 1986. DAR 57152, on female *Proctolaelaps* sp. in galleries of *I. grandicollis* in *P. elliottii*, Whiporie State Forest, N.S.W., Australia, C. Stone No. 197, 20th May, 1986. On protonymph *Proctolaelaps* sp. in galleries of *I. grandicollis in Pinus elliottii* Whiporie State Forest, N.S.W., Australia, C. Stone No. 199, 20th May, 1986.

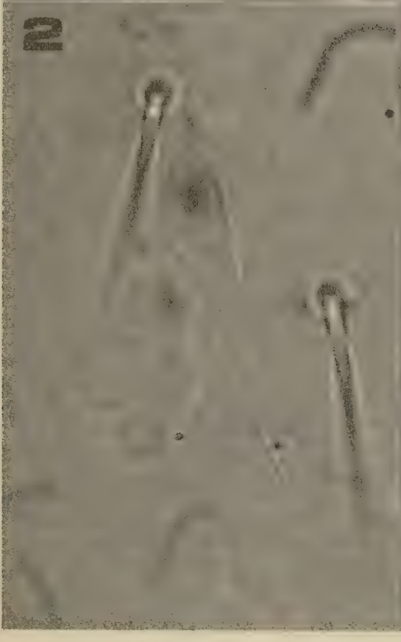
T. acarinophila most closely resembles *T. infuscata* Spegazzini (1918), *T. moseri* Majewski and Wisniewski (1978a), and the anamorph of *Pyxidiophora kimbroughii* Blackwell and Perry (Blackwell *et al.*, 1986b; Majewski and Wisniewski (1978b). *T. acarinophila* differs from these species by the smaller size of the thallus, the smooth hyaline basal cell, and the position of the holdfast. Other species of *Thaxteriola* have a small clear area at the holdfast (e.g. Blackwell *et al.*, 1986b, Figs. 7 and 9) which may be an haustorium penetration point or possibly a secretion point. We have not observed this feature on *T. acarinophila.*

As yet no species of *Pyxidiophora* has been observed in *I. grandicollis* infested billets of *Pinus* spp. in New South Wales despite long searches. It is likely that the teleomorph of *T. acarinophila* will be a species of *Pyxidiophora* (Blackwell *et al.*, 1986a, 1986b).

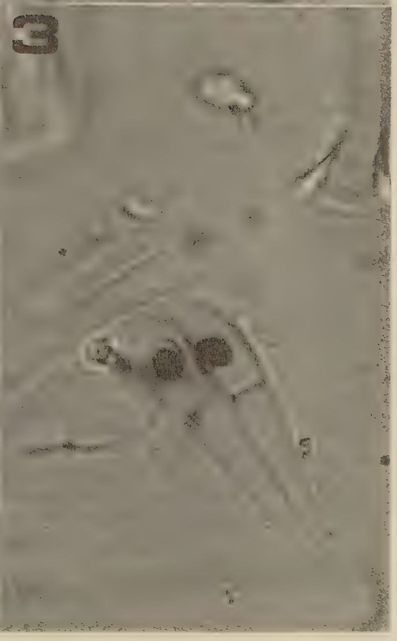
Fig. 1. Four thalli of *Thaxteriola acarinophila* on sternal shield of *Proctolaelaps* sp. (X40). Fig. 2. Thallus of *T. acarinophila* showing constriction between mid and basal cells and attachment of holdfast to mite cuticle (X80). Fig. 3. Thallus showing wall of holdfast (X80).



1



2



3

ACKNOWLEDGEMENT

We are grateful to Dr. M. Blackwell for helpful comments and a critical review of the manuscript. The Latin diagnosis was provided by C. Grgurinovic.

REFERENCES

Blackwell, M., Bridges, J.R., Moser, J.C. and Perry, T.J. (1986a). Hyperphoretic dispersal of a *Pyxidiophora* anamorph. Science 232: 993-995.

Blackwell, M., Perry, T.J., Bridges, J.R. and Moser, J.C. (1986b). A new species of *Pyxidiophora* and its *Thaxteriola* anamorph. Mycologia 78: 605-612.

Karg, W. (1985). Die raubmilbengattung *Proctolaelaps* Berlese, 1923. Zoologische Jahrbucher Systematik 112: 185-206.

Majewski, T., and Wisniewski, J. (1978a). New species of parasitic fungi occurring on mites (Acarina). Acta Mycologica 16: 3-12.

Majewski, T. and Wisniewski, J. (1978b). Records of parasitic fungi of the 'Thaxteriolae' group on subcortical mites. Mycotaxon 7: 508-510.

McGraw, J.R. and Farrier, M.H. (1969). Mites of the superfamily Parasitoidea (Acarina: Mesostigmata) associated with *Dendroctonus* and *Ips* (Coleoptera: Scolytidae). North Carolina Agricultural Experiment Station Technical Bulletin 192: 1-161.

Moser, J.C. and Roton, L.M. (1971). Mites associated with southern pine bark beetles in Allen Parish, Louisiana. Canadian Entomologist 103: 1775-1798.

Spegazzini, C. (1918). Observaciones microbiologicas. Anales Sociedad Cientifica Argentina, Buenos Aires 85: 311-323.

Womersley, H. (1956). On some new Acarina Mesostigmata from Australia, New Zealand and New Guinea. Journal Linnean Society - Zoology 42: 505-599.

MYCOTAXON

Vol. XXX, pp. 5-7 October-December 1987

COPROPHILOUS FUNGI FROM SPAIN VII.
Faurelina hispanica sp.nov.

M. Valldosera, J. Guarro & M. J. Figueras

Dpto. Biología y Microbiología, Universidad de Barcelona, Facultad de Medicina, 43201 Reus, Tarragona, Spain

SUMMARY

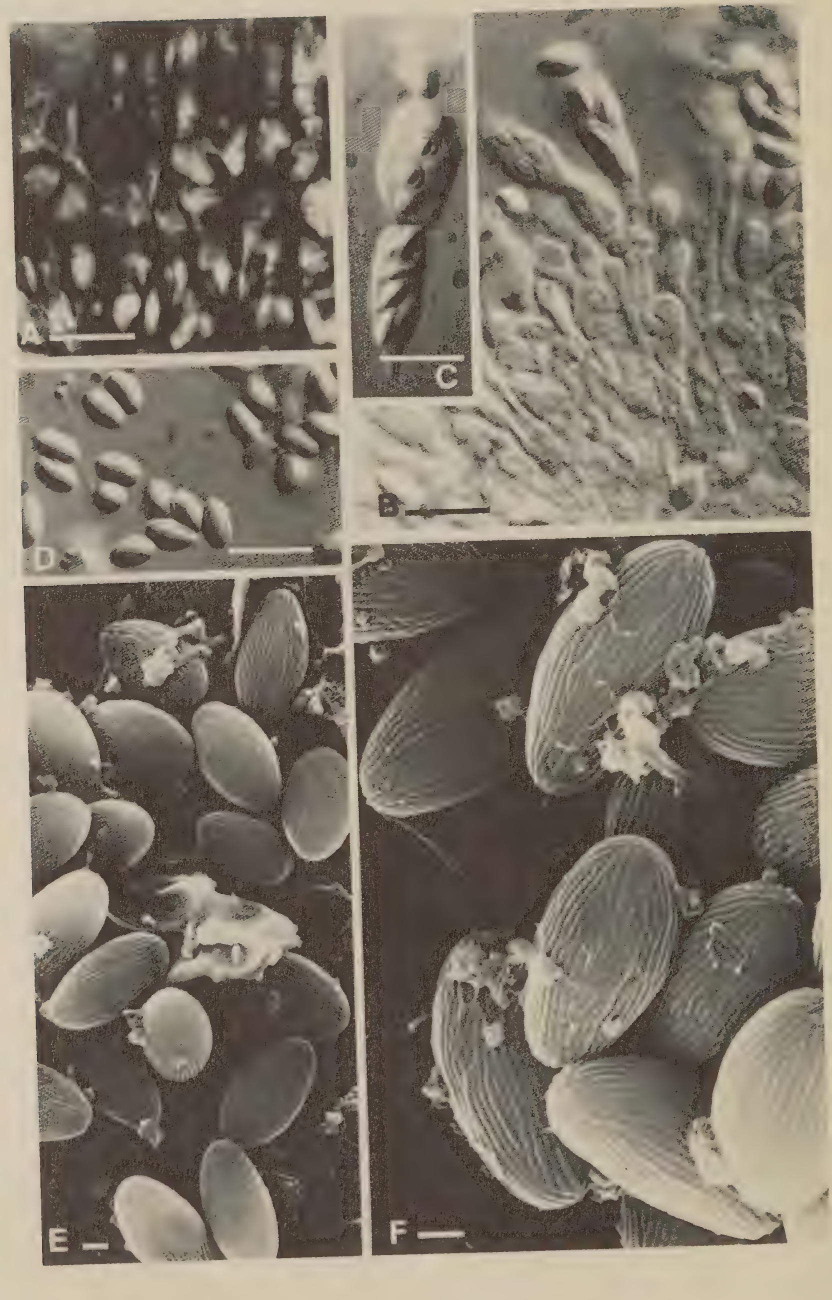
Faurelina hispanica spec. nov., collected on goat dung in Spain, differs from **F. elongata** by smaller ascospores and from **F. indica** by smaller ascospores and the absence of an anamorph.

The genus **Faurelina** Locquin-Linard is characterized by non-ostiolate, vertically elongated, often pustulate ascomata; pale brown, finely striate ascospores without germ pores and catenate asci (von ARX, 1978).
The first author of this paper collected on goat dung a similar fungus, which differs from the described species by smaller, especially narrower ascospores. It consequently is considered to represent a new species.

Faurelina hispanica Valldosera et Guarro sp. nov.

Fimicola. Ascomata deorsum immersa, semiglobosa, pustulata, sursum rotundata, levia, 200-300 µm diam, 300-400 µm alta, non-ostiolata; paries virides ad niger, e cellulis elongatis, verticaliter seriatis, 3-4 µm latis, crassitunicatis, incrustatis constans; asci catenati, fasciculati, in succesione basipetali formati, ellipsoidei, tenuitunicati, 8-spori, 19-22 x 6.5-8 µm; ascosporae ellipsoideae vel fusiformae, dilute brunneae, crassitunicatae, paucis sulcis et intumescentiis longitudinalibus ornamentatae, poris germinationis carentes, 5-6 x 2.5-3 µm. Conidia ignota.
Typus: FMR 892 (IMI 311251) in stercore caprino in Mont Car, Tarraco, Hispania collecte obtentus.

Ascomata immersed at the base, hemispherical or elongate, rounded above, smooth, 200-300 µm diam, 300-400 µm high, non-ostiolate; peridium green to black, composed of vertical rows of elongate, 3-4 µm broad, thick-walled, encrusted hyphal cells; asci fasciculate formed in basipetal chains, ellipsoidal or barrel-shaped, thin-walled, 8-spored, 19-22 x 6.5-8 µm; ascospores ellipsoidal-fusiform, pale brown, finely striate by longitudinal thickenings of the wall, without germ pores,


A
C
B
D
E
F

thick-walled, 5-6 x 2.5-3 µm. Anamorph unknown.
Type: FMR 892 (IMI 311251), from goat dung, Mont Car, Tarragona, Spain, collected by M. Valldosera, february 8, 1986.

The ascospores of the other species are 3.5-5 µm broad. The type species, **Faurelina fimigenes** Locquin-Linard (LOCQUIN-LINARD, 1975) was maintened by von ARX (1978) as a separate species, but FURUYA (1978) synonymized it with **Leuconeurospora elongata** Udagawa & Furuya (UDAGAWA & FURUYA, 1973). The combination **Faurelina elongata** was published simultaneously by von ARX (1978) and by FURUYA (1978). **F. indica** v. Arx et al. (von ARX et al., 1981) is the only species including an anamorph with relatively large, 1-septate, hyaline arthroconidia and with stalked blastoconidia.

LOCQUIN-LINARD (1975) classified **Faurelina** in the **Chadefaudiella**, von ARX (1978) tentatively in the Microascaceae, BENNY & KIMBROUGH (1980) in the Pithoascaceae, and finally von ARX (1981) in the Sordariaceae as a relative of **Neurospora**, which also includes species with striate ascospores (with germ pores) and with **Chrysonilia** anamorphs, rather similar to the anamorph of **F. indica**.

ACKNOWLEDGEMENT

We would like to thank Dr. J. A. von Arx (CBS, Baarn) for critically reviewing the manuscript.

REFERENCES

ARX J. A. von, 1978.- Notes on Microascaceae with the description of two new species. Persoonia, 10: 23-31.
ARX J. A. von, 1981.- On **Monilia sitophila** and some Families of Ascomycetes. Sydowia, 34: 13-29.
ARX J. A. von, MUKERJI K. G. and SINGH N., 1981.- **Faurelina indica** spec. nov. Sydowia, 34: 39-41.
BENNY G. L. and KIMBROUGH J. W., 1980.- A synopsis of the orders and families of the Plectomycetes with keys to genera. Mycotaxon, 12: 1-91.
FURUYA K., 1978.- Note concerning **Leuconeurospora elongata**. Trans. mycol. Soc. Japan, 19: 149-150.
LOCQUIN-LINARD M., 1975.- **Faurelina**, nouveau genre d'Ascomycetes. Revue Mycol., 39: 125-129.
UDAGAWA S. and FURUYA K., 1973.- The genus **Leuconeurospora**. J. Jap. Bot., 48: 111-116.

Figure 1.- **Faurelina hispanica**. A, cells of peridium. B, C, asci. D-F, ascospores. (A-D, bar=10 um. E-F, bar=1 um).

MYCOTAXON

Vol. XXX, pp. 9-28 October-December 1987

TAXONOMIC STUDIES IN THE GENERA PROTOUNGUICULARIA, ARACHNOPEZIZA AND DEMATIOSCYPHA

SEPPO HUHTINEN

Department of Biology, University of Turku,
SF-20500 Turku, Finland

ABSTRACT

Two species of *Protounguicularia* Raitv. & Galán are treated, their descriptions emended and the nature of their hair exudates discussed. They are transferred to *Arachnopeziza* Fuckel, and the value of the subiculum as a taxonomic criterium is discussed. Resinous exudates are shown to be a frequent character in *Arachnopeziza*. The confusion concerning the circumscription of *Dematioscypha* Svr. is clarified. The genus was typified with *Peziza dematiicola* Berk. & Br., but the description was based on two other taxa, *Urceolella richonis* Boud. and *Hyaloscypha olivacea* Vel., which also grow amongst *Haplographium*. These two taxa are congeneric with *P. dematiicola* and new combinations are proposed. *D. richonis* is recognized with two varieties which differ on the basis of ascal development and the color of the resinous exudates on the hairs. The type variety shows asci that develop from croziers and it represents the extreme in reddish tone of the resinous exudates. The other variety, with asci developing from simple septa, includes also the type of *Hyaloscypha olivacea*. It is characterized by brown resin. *Peziza dematiicola* is lectotypified.

This paper is a continuation in a series concentrated on the taxonomy of hyaloscyphaceous species characterized by glassy hairs or resinous exudates (Huhtinen 1987a, 1987b 1987c). With the addition of new taxa it has become clear that a closer scrutiny of hair exudates and wall characteristics needs more emphasis. For example, reporting the hairs as smooth or granulate is simply not enough. Even with a light microscope the nature of hair roughness can easily be resolved. If hairs are characterized by warts consisting of wall material, they are seen clearly only in optical section, whereas crystalline exudates (such as in

Lachnum Retz.) with different optical qualities are seen also in surface view. It is equally important to make a distinction between resinous exudates and "true" pigments. Also the nature of glassy substances has taxonomic significance, as already stated by Raschle (1977) and Korf & Kohn (1980).

Even if we extract such data, many questions remain unanswered. A particularly puzzling one, the delimitation of *Arachnopeziza* Fuckel, is treated below. With my interpretation the generic limits have perhaps become somewhat vague, but even the existing circumscription by Korf (1951, 1978) and Korf & Zhuang (1985) seems to make this inescapable, as detailed below. The second part of the paper deals with the taxonomic problems surrounding the genus *Dematioscypha* Svr.

I. A NEW INTERPRETATION OF ARACHNOPEZIZA AND OF PROTOUNGUICULARIA

The taxonomic placement of *Protounguicularia monoseptata* Galán & Raitv. and *P. variepilosa* Galán & Raitv. is a critical one. Two criteria of major importance in our present classification must be weighed against each other, i.e. the stated glassiness of hairs and the value of a subiculum as a generic criterion. As discussed earlier (Huhtinen 1987 b), I do not consider these two species to be congeneric with the type species of *Protounguicularia* Raitv. & Galán. The original concept of the genus was an expression of our present-day view that taxa with glassy hairs should be grouped separately from those with thin-walled hairs (cf. Raitviir & Galán 1986). I also share this opinion, with the addition that the nature of glassiness should also bear taxonomic weight. The type species of *Protounguicularia* has massive glassy deposits in the hairs, which places it close to other glassy-haired genera in Hyaloscyphaceae Nannf. The other two species of the genus do not show such deposits. Hence, their relationship to genera with thin-walled hairs must be reevaluated, especially the similarity to the genus *Arachnopeziza*. This makes a discussion of hair exudates and subiculum essential.

GLASSY SUBSTANCES

Even with a few dyes and reagents we can separate two types of refractive matter strengthening or solidifying the hairs. Though the accumulation of both types result in seemingly similar appearing hairs, the nature and causes of solidification are different. One type characterizes some species of *Hyaloscypha* Boud. In these species hair apices may be partially solid or, in the case of apically narrow hairs, the whole apex may be solid. Some other areas of the hair wall may also become thickened. In these cases it is hair wall material which accumulates. This can be verified using Melzer's reagent or ammoniacal Congo red which result in a uniform staining reaction. At least in *Hyaloscypha* this type of thickening can be used only at an infrageneric level. Consequently, species with thin-walled hairs and species with walls occasionally thickened in this manner may and must be accommodated in a same genus. This type of solidification is characterized by the fact that many hairs are only slightly thickened at their apex or are totally thin-walled, and only small minority of the hairs are solid in most of their apex.

In *Protounguicularia variepilosa* two kind of hairs are to be found: the most prevalent type is hyphoid and totally thin-walled while the remainder are similar but with a partially solidified apex. When present, the minutely thickened apical wall consists of homogenous appearing material. The thickening is inconspicuous and there are never glassy deposits like those in the type species of the genus. The deposits illustrated by Raitviir & Galán (1986, Figs. 12-19 and 64) most likely represent the resinous substance discussed below.

In the other type of hair solidification all or at least a majority of the hairs show conspicuous glassy deposits that are of a different material than the original hair wall. This can be clearly seen in *P. brevicapitata* Raitv. & Galán (= *P. barbata* (Vel.) Huhtinen, cf. Huhtinen 1987b). The solidifying substance stains distinctly in Melzer's reagent and Congo red, whereas the wall proper remains unstained. In *Hyalopeziza digitipila* Huhtinen also the difference between the solidifying substance and wall proper is clearly seen in Congo red, and in *Mollisina* Höhn. this substance dissolves or loses refractiveness in KOH, whereas the wall remains intact (Huhtinen 1987a). And even in *Urceolella carestiana* (Rab.) Dennis, where the glassy substance swells markedly in KOH, the differentiation between the wall and the solidifying substance can be seen. When stained in Congo red after KOH treatment, the hairs show a congophilous outer wall embracing the swollen, unstained substance. In *Hyalopeziza corticicola* (Dennis) Raitv. and in *H. valesiaca* Raschle the possible dual structure of hair walls is hard to observe. My observations in Congo red suggest, however, that the unstained glassy substance that forms most of the wall is surrounded by a congophilous outer wall. In any case such thickened walls characterizing all mature hairs bear taxonomic weight at the generic level, unlike the occasional wall thickenings in *Hyaloscypha* or in *Protounguicularia variepilosa*.

In all cases known to me the refractive material that forms hair walls or solidifies the hairs is impermeable to cotton blue (in lactic acid). In *P. monoseptata* hair apices and septal areas show a somewhat refractive substance which especially in Melzer's reagent looks glassy. But when the same mount is restained with cotton blue, the "glassy" areas are strongly cyanophilous and the material is thus clearly of plasmal origin. The same material results in the clearly banded appearance of hairs in cotton blue mounts (Figs. 3, 4.).

There is still one staining reaction in both *Protounguicularia monoseptata* and *P. variepilosa* that must be separated from the reactions of glassy substances. In Melzer's reagent some hairs show very strongly amyloid areas which occur independently of any morphological structure. The same intense violaceous reaction is more often seen in the excipulum as small nodules. Though hard to interpret, it seems that the color is located on the inner wall as a thin layer. So far I have seen this reaction only in *Hyaloscypha stevensonii* (Berk. & Br.) Nannf. where it is very rarely seen in the hairs but quite often observed in the excipulum. Most likely the photographs provided by Raitviir & Galán (1986, Figs. 58-61) represent this phenomenon, though the mountant is not stated by the authors.

RESINOUS EXUDATES

Both *Protounguicularia variepilosa* and *P. monoseptata* have a resinous exudate in and on the hairs, and to a lesser degree on the excipulum. This exudate is responsible for the yellowish brown color of some hairs and for gluing the hairs together. It is partly dissolved in Melzer's reagent and in heated lactic acid, but it can persist inside the hairs through many repeated heatings. In lactic acid the resin is dull to semi-refractive, much as in the illustrations by Raitviir & Galán (1986, Figs. 14, 15, 17).

The same type of resin is found in other hyaloscyphaceous species too, but occurs mostly on the hairs and is more easily dissolved. For example in *Hyaloscypha stevensonii* and in *Dasyscyphella crystallina* (Fuckel) Raitv. it is seen in abundance. Studying a majority of the species of *Arachnopeziza* from The Cornell University (CUP) collections I learned that at least seven species produce a similar resin. So far I have seen this feature coupled only with more or less cylindrical hairs.

The taxonomic value of this resinous exudate at the generic level is not yet clear to me. As I have seen in *H. stevensonii*, it is a relatively stable character at the species level. It is, however, noteworthy that in addition to the similarity in hair structure the two *Protounguicularias* show the same resin which characterizes so many species of *Arachnopeziza*. When mapping the total distribution of this resin, it is always necessary to mount a specimen first in water and only thereafter to other mountants which might otherwise dissolve the resin. Making our taxonomic decisions we must remember to keep such a resin separate from pigments incorporated in the hair walls or paraphyses. Such pigments are typically insoluble.

THE DELIMITATION OF ARACHNOPEZIZA

Korf (1978) erected a new subfamily Arachnopezizoideae to accommodate genera in which apothecia are borne on a sparse to dense subiculum and which have a refractive excipulum. I agree with Korf in placing such genera as *Arachnopeziza* and *Eriopezia* (Sacc.) Rehm emend. Höhnel in the family Hyaloscyphaceae. The excipular structure in *Arachnopeziza* does not allow exclusion from the family. After studying collections from the CUP herbarium of existing and undescribed members of the genus I could constitute a continuum from relatively thin-walled to heavily gelatinized textura prismatica. This variation is linked with the variation in subicular formation. These two characters occur in all combinations. Spore form or septation do not allow generic splitting either. This variation links the genus to the rest of the Hyaloscyphaceae.

In many species of *Arachnopeziza* the apothecia are surrounded by an obvious subiculum. There are, however, noteworthy exceptions. In *A. delicatula* Fuckel and *A. eriobasis* (Berk.) Korf apothecia of the same collection show variation from moderate subicular formation to a fringe of anchoring hyphae and even to total lack of any surrounding hyphae (studied with X180 magnification). In *A. trabinelloides* (Rehm) Korf and in *A. leonina* (Schw. : Fr.) Dennis the subiculum may be just a sparse web of aerial hyphae. *Arachnopeziza subnuda* Korf & Zhuang (1985) has only anchoring hyphae that become submerged at the base of apothecia. The tendency to form aerial mycelium on natural substrates is seen in other lignicolous, hyaloscyphaceous genera too, but never to the extent of forming an obvious subiculum. Both *Protounguicularia monoseptata* and *P. variepilosa* lack an obvious subiculum but form a scattered to occasionally weblike aerial mycelium. As this feature parallels that seen in *Arachnopeziza*, these two species would not be out of place in this genus. Among the combining characters are: the sessile apothecia, the cylindrical-septate hairs, the more or less unpigmented excipulum, the yellowish brown resin and the lignicolous habit.

The evidence I have seen suggests that we should delimit *Arachnopeziza* in such a way that the lack of subiculum in some species is recognized. In practice this has been done in the genus *Parachnopeziza* Korf (1978). Haines & Dumont (1983) have also acknowledged the somewhat vague delimitation of subiculum which characterizes the subfamily Arachnopezizoideae. I have also noted the functional variation of subicula. In *A. cornuta* (Ellis) Korf (Korf & Gruff, Disc. Exs. 95) and in *Eriopezia caesia* (Pers. ex Gray : Fr) Rehm subicular hyphae bear the same resin as the hairs and possibly have an equal excretory function, but in *A. leonina*, with abundant resin on the hairs, the scattered subicular hyphae lack resin and, consequently, the excretory function.

Two noteworthy characters, observed in the exsiccatum of *A. cornuta* (marked with "var?") by Korf & Gruff, deserve mention here. In this collection the spores show prominent hyaline appendages while still in the asci. The same character has been observed in *A. aurelia* (Pers. : Fr.) Fuckel (Korf, pers. commun.). The other noteworthy feature is the excipular structure which is best classified as textura oblita. The side walls frequently reach 2 μm in thickness, whereas the upper and lower wall are thin. This type of excipulum is exceptional in the genus. In those species with more gelatinized textura prismatica all the walls become equally thickened, resulting in a totally different appearance. This particular collection represents the extreme in excipular variation found in Hyaloscyphaceae and is annoying as we can not distinguish whether it is a result of anomalous wall thickening of textura prismatica or whether it is an originally hyphoid structure with thickened side walls and thin septa.

THE TRANSFER OF TWO PROTOUNGUICULARIAS

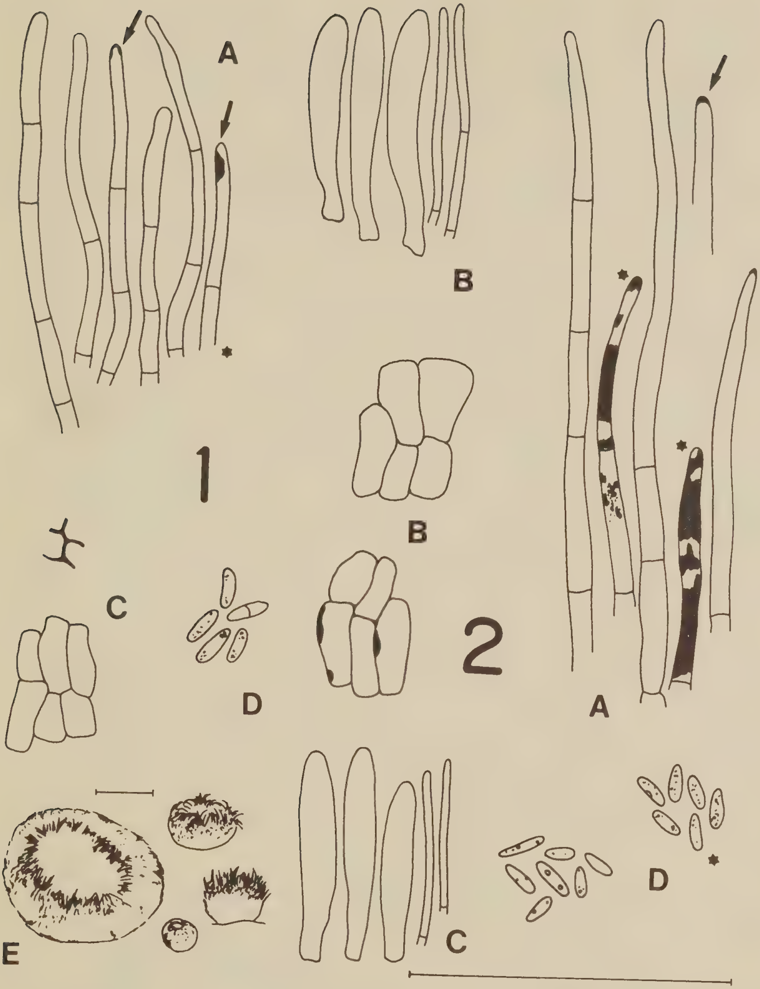
As discussed above the two *Protounguicularia* species show relationship to *Arachnopeziza*, even as presently circumscribed by Korf (1951, 1978) and Korf & Zhuang (1985). These two species are among those that occupy a transitional position between the two subfamilies (cf. Korf 1978). Three possibilities exist for their generic placement. They can be grouped together as a new genus stressing the lack of glassy hairs and the lack of a prominent subiculum. Or they can be accommodated in *Arachnopeziza* or *Psilocistella* Svrček.

The first choice would be an unhappy one, creating a genus with vague delimitation from both *Arachnopeziza* and *Psilocistella*. The latter genus is relatively new and its delimitation is problematic. It is typified with *Hyaloscypha priapi* Vel. var. *obsoleta* Vel., which has been illustrated by Svrček (1977) and Huhtinen (1987d). Of the constituent species, *P. lignatilis* (Vel.) Svrček and *P. vernalis* (Vel.) Svrček are the closest relatives of the type with short, septate and cylindrical hairs. A study on the neotype of *P. conincola* (Vel.) Svrček revealed that this species is intermediate between *Psilocistella* and *Hamatocanthoscypha* Svrček. Obviously *P. quercina* (Vel.) Svrček, which does not have septa in the protruding part of the hairs, should be accommodated in some other genus (cf. Svrček 1977, 1979, 1983, 1985).

My personal collections and studies of material from the PRM herbarium indicate that at least two additional and possibly important characters occur in the genus, i.e. one to three septa and brown pigments in spores (while still in the asci). The septate-spored species in *Psilocistella*, *P. vernalis*, has dextrinoid hairs and excipulum as already noted by Svrček (1985). Furthermore, I have noted no tendency to formation of aerial mycelium in the genus *Psilocistella*. And as all the species seem to be more or less stipitate, I prefer to transfer the two species of *Protounguicularia* to *Arachnopeziza*. The new combinations are proposed below and the original diagnoses are emended:

ARACHNOPEZIZA VARIEPILOSA (Galán & Raitv.) Huhtinen, comb. nov. -Figs. 1-2.

≡ *Protounguicularia variepilosa* Galán & Raitv., Int. J. mycol. lichenol. 2: 223. 1986.



Figs. 1-2. *Arachnopeziza variepilosa*. 1) Huhtinen 86/60 (TUR). A) hairs in cotton blue and Melzer's (marked), arrows indicate solid apex and amyloid reaction B) asci and paraphyses C) ectal excipulum D) spores in cotton blue E) dried apothecia - 2) Holotype of *Protounguicularia variepilosa* (Herb. Galán). A) hairs in cotton blue, marked showing the resinous contents, arrow indicating solid apex B) ectal excipulum, lower with amyloid nodules C) asci and paraphyses D) spores in cotton blue and Congo red (marked) - Scale 50 µm, for apothecia 100 µm.

Apothecia gregarious to confluent, at first globose and narrowly sessile, later cupulate and broadly sessile, up to 0.5 mm in diameter when dried, pure white in fresh, juvenile specimens, disc soon becoming brownish, margin white due to the hairs; flanks clearly brownish when dried.

Ectal excipulum of textura prismatica, cells varying in size from 8-12 X 4-5 µm to 12-15 X 5-8 µm, walls hyaline to very slightly brownish, typically at places densely covered with brown exuded substance which is resistant to Congo red and KOH and partially to Melzer's reagent, but dissolved in heated cotton blue or lactic acid mounts; walls thin to 0.4 µm thick in lactic acid, refractive, J- except for frequent clearly amyloid areas (without KOH pretreatment), after KOH pretreatment still nondextrinoid, not taking color in cotton blue or Congo red; inner excipulum of similar but narrower textura prismatica.

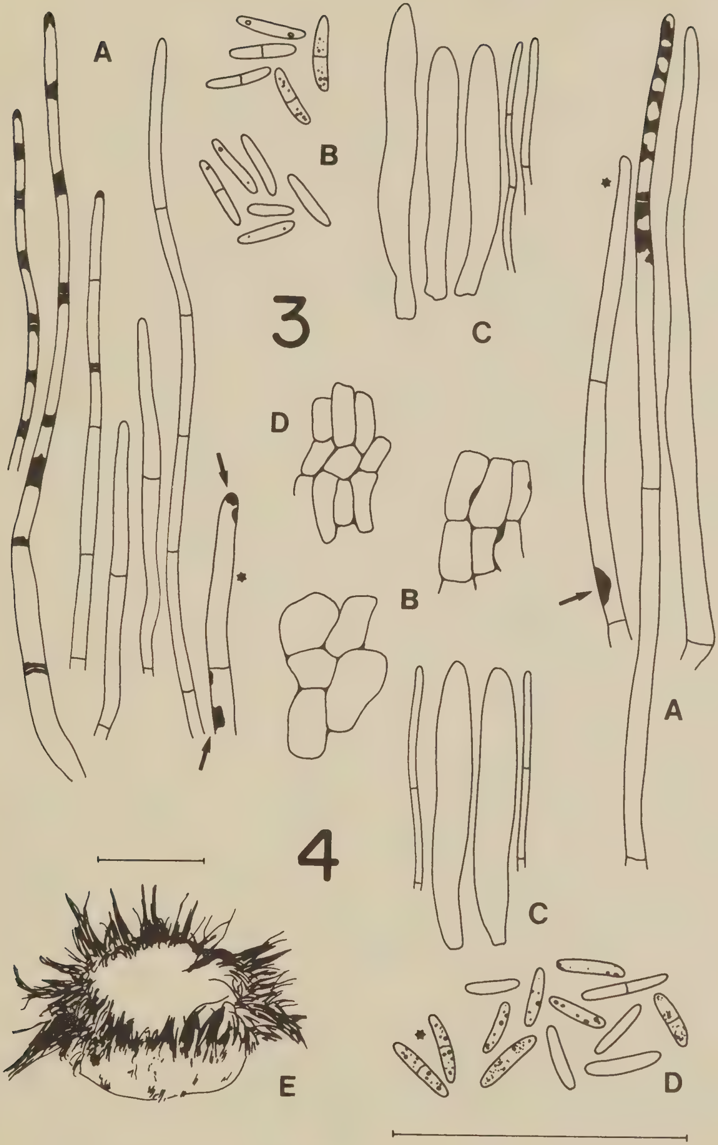
Hairs up to 100 µm long, 2-4 µm broad at base, septate, irregularly cylindrical, hyaline to yellowish brown under the microscope, color not located in the wall but concentrated in resinous exudates, without glassy deposits, the apical wall very rarely thickened, apices occasionally tapered but still blunt; walls thin to slightly thickened (0.3 µm in lactic acid), J- except for occasional clearly amyloid areas, not taking color in cotton blue or Congo red; the resinous exudate partly dissolving in heated cotton blue, almost totally lost with repeated heatings, from the surface partly dissolving in Melzer's reagent, cyanophilous.

Asci cylindrical, developed from croziers, 26-33 X 4-6 µm, eight-spored, pore channel wall faintly to clearly amyloid without KOH pretreatment. Ascospores ellipsoid to subfusoid, 4-7 X 1.8-2.0 µm, not becoming septate in asci, very rarely one-septate after being discharged, minutely guttulate in cotton blue, more prominently in KOH. Paraphyses narrowly cylindrical, 1.5-1.8 µm broad below, occasionally apices up to 2.0 µm broad, not protruding above the asci, terminal cells 15-28 µm long, with or without a hyaline, gelatinous matrix (in Congo red).

Material studied: CZECHOSLOVAKIA. Bratislava area, by the river "Vydrica", on deciduous wood, 4.VIII.1986 Lizoň & Huhtinen 86/60 (TUR). SPAIN. Cádiz, Grazalema, on wood

---

Figs. 3-4. *Arachnopeziza monoseptata.* 3) Isotype of *Protounguicularia monoseptata* (Herb. Galán). A) hairs in cotton blue and Melzer's (marked), arrows indicating amyloid reaction B) spores in Melzer's and lactic acid (lower) C) asci and paraphyses D)ectal excipulum - 4) *Arachnopeziza n.sp.* Korf, ined. (CUP). A) hairs in cotton blue and Melzer's (marked), arrow indicating the amyloid reaction B) ectal excipulum, upper with amyloid nodules C) asci and paraphyses D) spores in cotton blue and Melzer's (marked) E) dried apothecium - Scale 50 µm, for apothecium 200 µm.


A
B
C
3
D
B
A
4
C
E
D

of *Abies*, 27.XI.1982 Galán (Herb. Galán, holotype of *Protounguicularia variepilosa*).

ARACHNOPEZIZA MONOSEPTATA (Galán & Raitv.) Huhtinen, comb. nov. -Figs. 3-4.

≡ *Protounguicularia monoseptata* Galán & Raitv., Int. J. mycol. lichenol. 2: 224. 1986.

Apothecia gregarious, at first globose-cupulate, subsessile to very shortly stipitate, becoming cupulate, sessile to seemingly sessile, stipe superficial; up to 0.4 mm in diameter when dried, flanks yellowish brown to moderately brown, margin white, disc brownish.

Ectal excipulum of textura prismatica, cells varying in size from 8-12 X 3-4 µm to 12-14 X 6-10 µm; walls moderately brownish under the microscope, thin, not covered by exudates, J- except for frequent clearly amyloid areas (without KOH pretreatment), when KOH pretreated still nondextrinoid, not taking color in cotton blue or Congo red.

Hairs up to 150 µm long, 2-5 µm broad at base, septate, cylindrical, hyaline to yellowish brown under the microscope, color not located in the wall but in the exudates, with or without dull to semi-refractive deposits at the blunt apices and at septal areas; short, brown-walled hairs may rarely be present at the base of apothecia; walls thin, J- except for occasional clearly amyloid areas, not colored in cotton blue or Congo red; the resinous exudate partly dissolving in Melzer's reagent and heated lactic acid, partly persistent even after a few repeated heatings; the material, responsible for the somewhat glassy appearance, not stained in Melzer's reagent but clearly stained in cotton blue and Congo red; occasionally also the wall at the hair apex may be minutely thickened.

Asci cylindrical, developed from croziers, 42-53 X 5-7 µm, eight-spored, pore channel wall clearly amyloid without KOH pretreatment. Ascospores ellipsoid to oblong-ellipsoid, 10-16 X 2-3 µm, occasionally becoming one-septate even in asci, after being discharged more frequently septate, with or without small guttula, septum not dextrinoid. Paraphyses narrowly cylindrical, 1.5-1.8 µm broad, not protruding above the asci, occasionally with the same semi-refractive substance as seen in some hairs, terminal cells 12-20 µm long.

Material studied: NORWAY. Finnmark, Karasjok, Karasjåkka, on a board, 22.VIII.1978 Sivertsen & Dissing & Korf (CUP 59279, sub *Arachnopeziza sp.nov., ined.*). SPAIN. Malaga, Ronda, on wood of *Abies*, 2.IV.1984 (Herb. Galán, isotype of *Protounguicularia monoseptata*).

ERRATA, VOLUME THIRTY

Page	19	line 20	for	*catenulatum*	read	*catenatum*
	20	13, 20	for	*catenulatum*	read	*catenatum*
	21	7	for	*catenulatum*	read	*catenatum*

SEE ERRATA

II. THE GENUS DEMATIOSCYPHA

When Svrček (1977) created the new genus *Dematioscypha*, he typified it with *Peziza dematiicola* Berk. & Br. The material he studied was, however, a different species. The generic name is tied to the type of *Peziza dematiicola*, a species characterized by sharply pointed, aseptate, thick-walled hairs. Berkeley & Broome (1865) did not indicate any specific collections, nor has a type been effectively selected in the treatments by Massee (1895), von Höhnel (1909) and Nannfeldt (1936). Hence, a collection by Broome in Berkeley's herbarium (March 31, 1863; in K) is designated here as a lectotype of the species. This is the same collection which was studied by von Höhnel and bears his annotations. By a comparison of the types of *Dasyscypha heimerlii* Höhnel and *P. dematiicola* I have verified the conspecifity already stated by von Höhnel (1909).

The material that Svrček used in creating the genus *Dematioscypha* is conspecific with the types of *Hyaloscypha olivacea* Vel. and *Urceolella richonis* Boud., both of which grow amongst *Haplographium catenuatum* (Preuss) Hol.-Jech. (= *H. delicatum* Berk. & Br.). Although both of them have cylindrical-tapering, septate, thin-walled hairs, they have remained hidden during the treatments concerning the placement of *Peziza dematiicola*. Below they are treated as a single species but separated at a varietal level.

The differences in hair characters between *Dematioscypha dematiicola* (Berk. & Br.) Svrček (in the original sense) and *U. richonis* were at first considered to warrant their placement into different genera. But a large material I studied revealed the important fact that the sharply pointed hairs in *D. dematiicola* can also be truly septate (Fig. 13). This character is not seen in all collections and can be considered as a rare one, but it shows that the hairs alone can not be taken as a criterium for the separation of two different genera. The total lack of a resinous exudate in dried material of *D. dematiicola* and its abundance in all collections of the two other taxa serves as a rapid means of macroscopic recognition, but hardly as a decisive generic criterion.

Dematioscypha dematiicola and *Urceolella richonis* are congeneric through identical ecology, identical hymenial characters and identical excipular structure. They all have a very rare type of excipulum characterized by unevenly thickened and pigmented walls, whereas the majority of genera with a brown excipulum have regular coloring and wall thickness. Because the differences in hair characters are not totally clear-cut, the placement of *U. richonis* into *Dematioscypha* seems justified. The rare type of excipulum is seen outside this genus only in *Eriopezia caesia*. In this genus the hairs are cylindrical and septate but at least in *E. caesia* they are branched and anastomosing, like the subicular hyphae.

The hairs of *D. dematiicola* are of the same basic type

SEE ERRATA

as in a majority of *Hyaloscypha* species, but modified by their tendency to accumulate wall material even to the extent of solidifying the hairs. This character is seen also in some species of *Hyaloscypha* but at a much smaller scale, and hairs that become apically solid are usually very thin. The genus *Dematioscypha* deserves recognition on the basis of quite many characters: it has a specific ecology, is characterized by a rare excipular type and has inamyloid asci. In addition, the genus has hairs that are either typically or more rarely septate in their protruding parts.

The connection between *D. dematiicola* and *Haplographium catenuatum* was reported by Hughes (1953) in a footnote. He used material determined by Dennis, which I have seen to contain both *Dematioscypha* species. So it is not clear with which species Hughes worked. As it seems that all the later reports on the connection are just a repetition of Hughes's statement, new cultural studies are needed. Unfortunately neither species has been found in Finland. In some collections *H. catenuatum* with abnormal conidial development is seen, or these represent another species of *Haplographium* Berk. & Br. (Fig. 7.). This characters is not, however, solely connected to either species of *Dematioscypha*. Hughes (1953) discussed the abnormalities in conidial heads of *Haplographium*, but did not indicate the presence of such conidiophores as seen in Fig. 7.

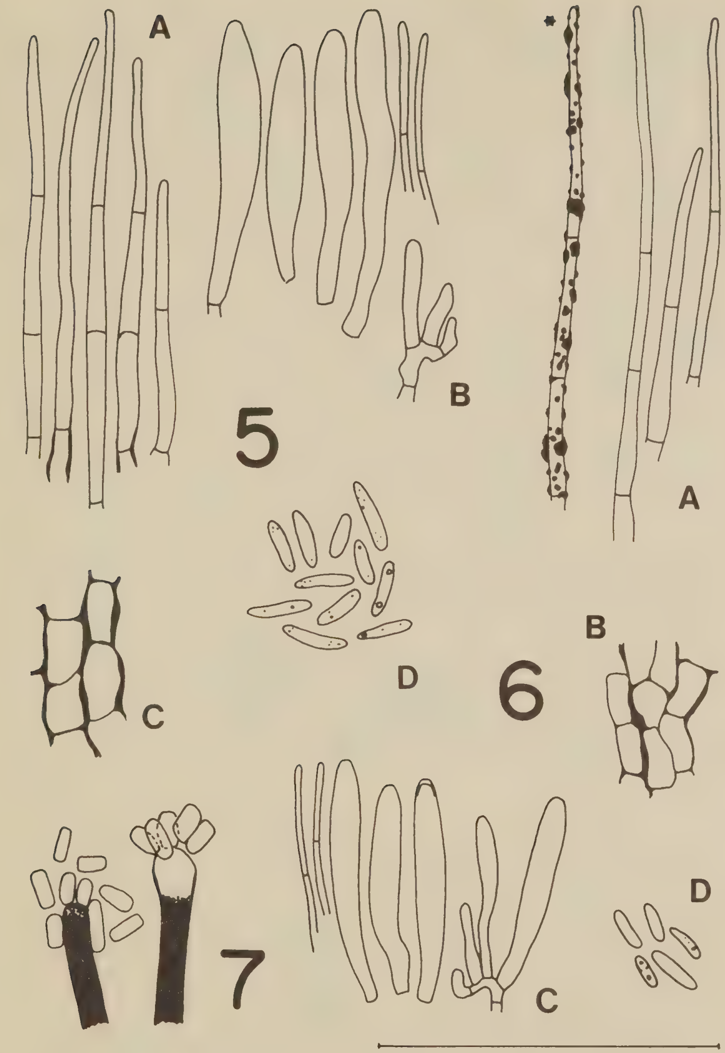
The genus *Dematioscypha* seems to be restricted to non-coniferous substrates. With the exception of one collection from *Rubus*, the studied material has been collected on deciduous wood only. This preference may also be dictated by *Haplographium* being unable to grow on coniferous wood. Species of *Brachysporium* Sacc. are also often seen growing with *Dematioscypha* and a few collections are known in which old myxomycetes were in close association. I have yet to see an apothecium growing without its claimed conidial state. The following new combinations are proposed:

DEMATIOSCYPHA RICHONIS (Boud.) Huhtinen, comb. nov. VAR. RICHONIS -Figs. 8-10.

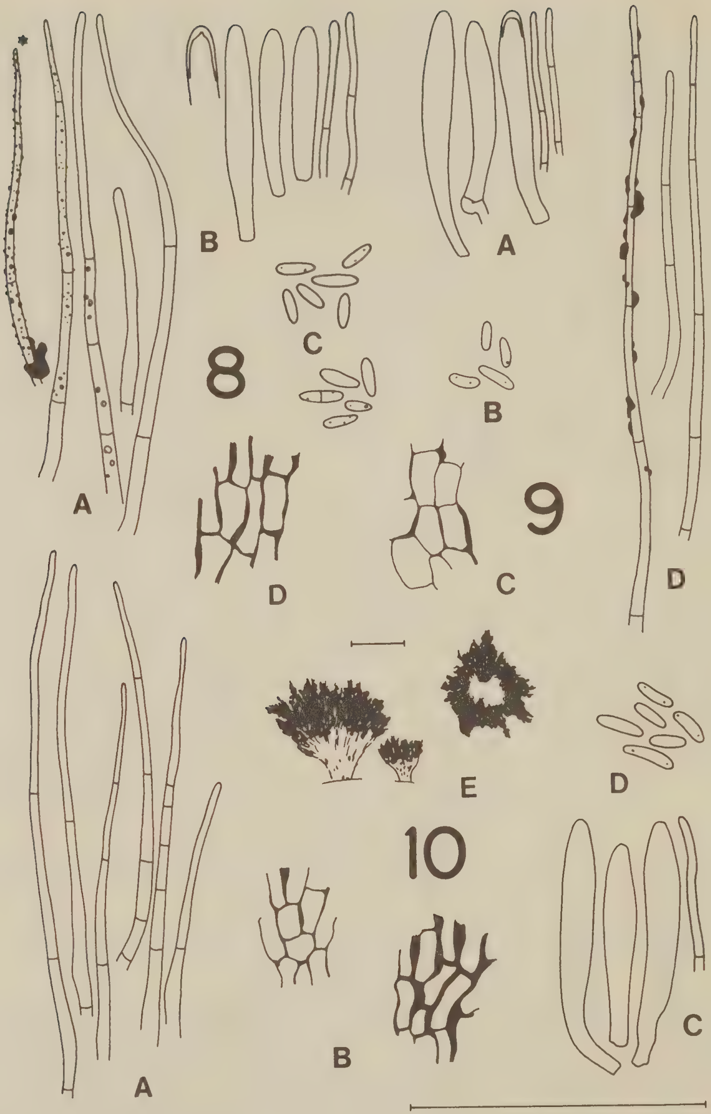
≡ *Urceolella richonis* Boud., Bull. Soc. mycol. Fr. 4: 82. 1888.

Apothecia gregarious, cupulate on a narrowing base or with a short stipe, more rarely broadly sessile, up to 0.5 mm in diameter when dried, disc and flanks black when dried but overall color of apothecia moderately brown to clearly red due to the resinous exudates.

Ectal excipulum of textura prismatica, cells varying in size from 8-12 X 4-6 µm to 10-12 X 6-9 µm (more rarely), at base of apothecia textura angularis; walls moderately to definitely brown, of highly unequal thickness, pigment stable in all mountants, covered in places by the same resin as hairs; inner excipulum of similar but narrower textura prismatica, also the ascogenous hyphae brownish.



Figs. 5-7. *Dematioscypha richonis* var. *olivacea* and *Haplographium*. 5) Nannfeldt 20.VIII.1929 (UPS). A) hairs in cotton blue B) asci and paraphyses C) ectal excipulum D) spores in lactic acid - 6) Holotype of *Hyaloscypha olivacea* (PRM). A) hairs in lactic acid and water (marked) B) ectal excipulum C) asci and paraphyses D) spores in cotton blue - 7) *Haplographium catenuatum*, abnormal conidial development - Scale 50 µm.



Figs. 8-10. *Dematioscypha richonis* var. *richonis*. 8) Holotype of *Urceolella richonis* (P). A) hairs in lactic acid and Melzer's (marked) B) asci and paraphyses C) spores in lactic acid and Melzer's (upper) D) ectal excipulum - 9) Svrček 30.X.1965 (PRM). A) asci and paraphyses B) spores in Melzer's C) ectal excipulum D) hairs in

Hairs up to 80 µm long, 2-3 µm broad at the base, septate, narrowly cylindrical, brown to clearly reddish under the microscope, color not located in the wall but in the exudate, without glassy deposits, apices occasionally tapering but still blunt; walls thin to 0.3 µm thick (in lactic acid), hyaline, J- even with KOH pretreatment, faintly stained in Congo red, acyanophilous, smooth in heated cotton blue, septa clearly stained in Congo red; the exudate occurring as amorphous lumps on the hairs, somewhat resistant to Melzer's reagent, totally dissolved in repeated heatings in cotton blue and KOH mounts, yellowish brown to more or less clearly reddish in lactic acid and KOH, in squash mounts color occasionally penetrating some hair compartments and coloring them.

Asci cylindrical, developed from croziers, 30-42 X 4-6 µm, eight-spored, pore channel wall J- even with KOH pretreatment. Ascospores ellipsoid to subfusoid, straight to slightly bent, 5-8(-10) X 1.5-2.0(-3.0) µm, remaining nonseptate in asci, rarely one-septate after being discharged, aguttulate to minutely guttulate in cotton blue and Melzer's reagent. Paraphyses filiform, 0.8-1.5 µm broad, not protruding above the asci, devoid of pigments, terminal cells typically 10-20 µm long.

Material studied: CZECHOSLOVAKIA. Bohemia, Třeboň, on *Alnus* wood, 30.X.1965 Svrček (PRM). FRANCE. Saint-Amand-sur-Fion, on *Populus* wood, XII.1885 Richon (P, holotype of *Urceolella richonis*). GERMAN DEMOCRATIC REPUBLIC. Prignitz, Triglitz, on deciduous wood, 1.VIII.1908 Jaap (S, Herb. Rehm). GREAT BRITAIN. Yorkshire, Whitby, on deciduous wood, IX.1900 (K, Herb. Crossland; NY, Herb. Massee). Warwickshire, Weethley, on *Rubus* stems, 1.XI.1969 Clark (K) Berkshire, Moorfield, on *Corylus* wood, 22.X.1950 Wakefield (K). U.S.A. New York, Star Lake, on *Acer* wood, 8.IX.1974 (DAOM).

DEMATIOSCYPHA RICHONIS (Boud.) Huhtinen VAR. OLIVACEA (Vel.) Huhtinen, comb. et stat. nov. -Figs. 5-6.

≡ *Hyaloscypha olivacea* Vel., Monogr. Discom. Bohemiae 1: 282. 1934.

Misapplication: *Dematioscypha dematiicola* (Berk. & Br.) Svrček sensu Svrček 1977.

This variety is distinguished by two major characters. The ascal development is different from var. *richonis*. The asci arise from simple septa and not from croziers. Fur-

---

Melzer's E) dried apothecia - 10) IX.1900 (Herb. Crossland, K). A) hairs in lactic acid B) ectal excipulum C) asci and paraphyses D) spores in lactic acid - Scale 50 µm, for apothecia 100 µm.

hermore, the dried apothecia always lack the prominent red tinge in their resinous exudate. This difference is culminated when compared to type material of *Urceolella richonis* But especially when mounted in KOH, a reddish brown tinge can be noted in var. *olivacea* too, but never to the extent of affecting the overall color of apothecia. Some collections of the type variety have larger apothecia or slightly narrower hairs than those of var. *olivacea*, but also these features show a continuum between the two varieties. In many cases the ascal bases are the only stable distinguishing character to be found.

Particularly interesting is a specimen from NY of var. *richonis* (Herb. Massee), which is a fragment of the same collection that was treated by Dennis (1949). Here the two varieties grow 1 cm apart and are separated by their ascal bases, color of resin and size of apothecia. It is noteworthy that the apothecia with the deepest red color in resin are typically robust, reaching 0.5 mm in diameter when dried. A study of the holotype of *U. richonis* showed that Boudier has somewhat exaggerated the tapering nature of hairs (cf. Boudier 1888, 1905-1910 and Fig. 8).

As there is one clear-cut difference and additional gradual differences, I prefer to recognize two varieties rather than two formae. So far there seems to be no support for valuing ascal bases as a character automatically separating different taxa as separate species. So far both varieties have been collected equally often, but collections with the deepest red tinge in resin seem to be rare.

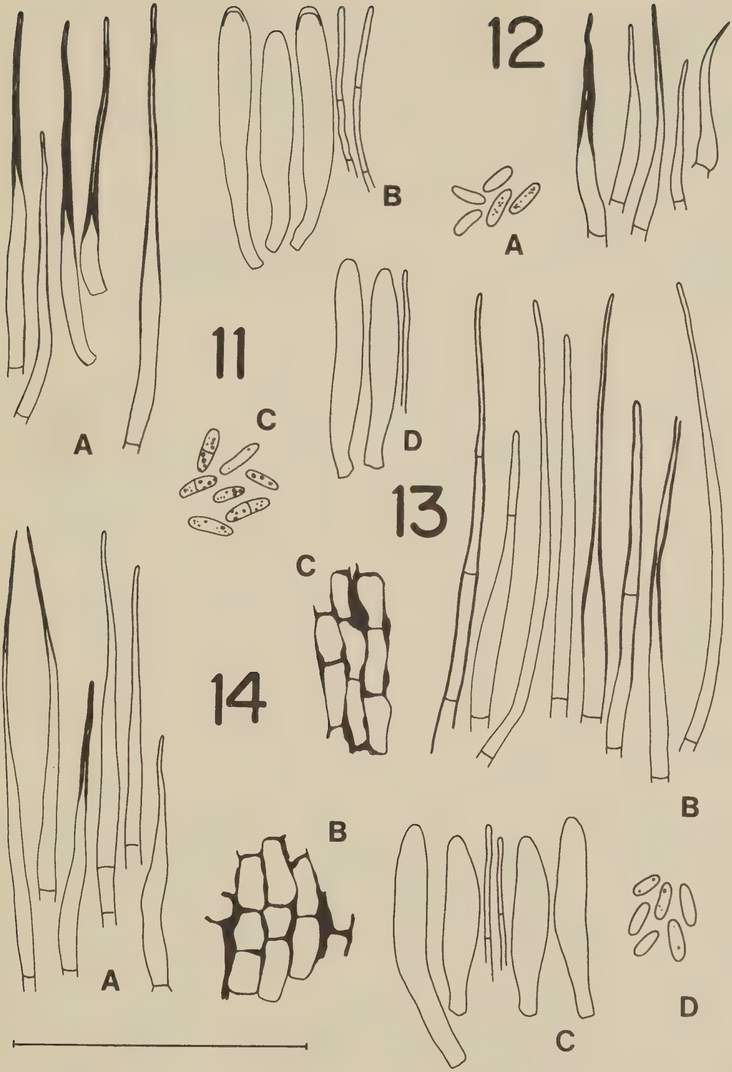
Material studied: AUSTRIA. Wienerwald, on deciduous wood, 29.VI.1905 Höhnel, sub. *Dasyscypha heimerlii* (F). CZECHOSLOVAKIA. Bohemia, Jirna, on *Quercus* cortex, 30.V. 1925 Velenovský (PRM, holotype of *Hyaloscypha olivacea*). GREAT BRITAIN. Surrey, Ashstead Common, on *Betula* wood, 29.II.1948 Hughes (K). Suffolk, Redgrave Fen, on *Quercus* wood, 30.X.1980 Ellis & Ellis (IMI). Suffolk, on *Quercus* wood, 22.IV.1981 M.B. Ellis (IMI). Isle of Lewis, Stornoway, on *Alnus* wood, 6.V.1974 Dennis (K). SWEDEN. Småland, Femsjö, on *Salix* wood, 20.VIII.1929 Nannfeldt (UPS). Uppland, Börje, on *Populus* wood, 8.VI.1947 Nannfeldt (UPS).

DEMATIOSCYPHA DEMATIICOLA (Berk. & Br.) Svrček - Figs. 11-14.

≡ *Peziza dematiicola* Berk. & Br., Ann. & Mag. Nat. Hist. Ser. 3, 15: 446. 1865, non sensu Svrček 1977 (= *Dematioscypha richonis*)

= *Dasyscypha heimerlii* Höhnel, Sitzb. k. Akad. Wissensch. Wien, Math.-nat. Cl., Abth. 1, 111: 1002. 1902.

Apothecia gregarious, cupulate on a short stipe, later becoming sessile on a narrowing base, up to 0.3 mm in



Figs. 11-14. *Dematioscypha dematiicola*. 11) Lectotype of *Peziza dematiicola* (Herb. Berkeley, K). A) hairs in cotton blue B) asci and paraphyses C) spores - 12) Holotype of *Dasyscypha heimerlii* (Herb. Höhnel, F), hairs in cotton blue - 13) Coppins 10.X.1979 (E). A) spores B) hairs C) ectal excipulum D) asci and paraphyses - 14) Höhnel 21.V. 1903 (F). A) hairs B) ectal excipulum C) asci and paraphyses D) spores in cotton blue - Scale 50 µm.

diameter when dried, disc and flanks black to blackish brown when dried, margin pure white.

Ectal excipulum of textura prismatica, cells 6-10(-12) X 4-6 µm, walls clearly brown to blackish brown, of highly unequal thickness, pigment stable in all mountants; inner excipulum of similar but narrower textura prismatica; ascogenous hyphae also brownish.

Hairs up to 80 µm long, 3-4 µm broad at the base, typically aseptate in their protruding part, rarely multiseptate, often tapering to a fine point less than 1 µm broad, rarely more than 1.5 µm broad at apex, lacking resinous exudates; walls thin at base, more or less clearly thickened apically, often only a narrow lumen visible at the upper part, rarely totally obscuring the lumen, hyaline, J- even with KOH pretreatment, acyanophilous, faintly stained in Congo red, smooth.

Asci cylindrical, developed from croziers, 30-50 X 4-6 µm, eight-spored, pore channel wall J- even with KOH pretreatment. Ascospores ellipsoid to subfusoid, straight to slightly bent, 5-8(-10) X 1.5-2.0 µm, remaining nonseptate in asci, quite frequently one-septate after being discharged, aguttulate to minutely guttulate in cotton blue and Melzer's reagent. Paraphyses filiform, 0.8-1.5 µm broad, not protruding above the asci, devoid of pigments, terminal cells typically 10-25 µm long.

In dried material the difference in general appearance between the two species of *Dematioscypha* is striking. *D. dematiicola* has no resin on its hairs, so the hairs are pure white and in strong contrast to the flanks, whereas in *D. richonis* the exudate obscures the true color of hairs. *D. dematiicola* has somewhat darker pigment in the excipular walls and the spores are more often one-septate after being discharged.

Material studied: AUSTRIA. Wienerwald, Viehöferin, Pressbaum, on *Carpinus* wood, 19.IX.1902 Höhnel (F, holotype of *Dasyscypha heimerlii*). Wienerwald, Pfalzau, on *Carpinus* wood, 21.V.1903 Höhnel (F). Wienerwald, on *Fagus* wood, 8. VII.?. Höhnel (F). Wienerwald, on *Fagus* wood, 21.V.1903 Höhnel (F). Schneeberg, on *Carpinus* wood, VIII.1902 Höhnel (S, Herb. Rehm). CANADA. Quebéc, Old Chelsea, on deciduous wood, 21.X.1954 Hughes (DAOM). Quebéc, Kingsmere, on deciduous wood, 6.X.1952 Hughes (DAOM). British Columbia, Lake Cowichan, 6.VII.1972 Hughes (DAOM). GREAT BRITAIN. ?? No. 294, on rotten wood, 30.III.1860 (K). Surrey, on *Fagus* wood, 23.I.1949 Hughes (IMI). Surrey, Ranmore Common, on *Fagus* wood, 13.VI.1986 Hughes (IMI). Yorkshire, Swinton Park, on *Quercus* wood, 3.IV.1947 Hughes (IMI); on *Quercus* chip, 13.X.1974 Hughes (IMI); on *Fagus* wood, 27.IX.1948 Hughes (IMI). Yorkshire, on *Quercus* wood, 17.IX.1949 Hughes (IMI). Grovestershire, Cotswold Hills, on deciduous wood, 1.XI.1975 Preston-Matham (K). North Wales, Nant Crafnant Valley, on deciduous wood, Hughes (DAOM); on deciduous wood, 17.V.1958 Hughes (DAOM). Isle of Arran, Brodick, on *Rhododendron* wood, 8.IX.1980 Kirk (K). Isle of

Skye, Uig, on deciduous wood, 25.V.1979 Dennis (K). Dunbarton, Loch Lomond, on *Fraxinus* wood, 10.X.1979 Coppins (E). Scotland, Tongue, on *Betula* cortex, 13.V.1985 Kirk (IMI). Scotland, Lochaker, L. Ailot, on *Corylus* wood, 5.V. 1984 Dennis (K). NEW ZEALAND. Auckland, Piha Stream, on *Cordyline australis*, 11.VI.1963 Dingley (DAOM). Auckland, Tititangi, on rotten wood, 22.I.1963 Hughes (DAOM).

ACKNOWLEDGEMENTS

Prof. R.P. Korf and Dr. J.H. Haines are kindly thanked for reading through this paper and for their many valuable corrections and improvements.

LITERATURE CITED

BERKELEY, M.J. & BROOME, C.E. 1865. Notices of British Fungi. Ann. & Mag. Nat. Hist. Ser. 3, 15: 444-452.
BOUDIER, M. 1888. Nouvelles espèces de Discomycètes inoperculés de France. Bull. Soc. mycol. Fr. 4: 76-86.
-- 1905-1910. Icones Mycologicae. Klincksieck, Paris.
DENNIS, R.W.G. 1949. A revision of the British Hyaloscyphaceae, with notes on related European species. Mycol. Pap. 32: 1-97.
HAINES, J.H. & DUMONT, K.P. 1983. Studies in the Hyaloscyphaceae 2: *Proliferodiscus*, a new genus of Arachnopezizoideae. Mycologia 75: 535-543.
HÖHNEL, F. von. 1909. Fragmente zur Mykologie. VII. Mitteilung. Sitzb. k. Akad. Wissensch. Wien, Math.-nat. Cl., Abth. 1, 118: 1-92.
HUGHES, S.J. 1953. Conidiophores, conidia, and classification. Can. J. Bot. 31: 577-659.
HUHTINEN, S. 1987a. Three new species, and the histochemical delimitation of genera in the glassy-haired Hyaloscyphaceae. Mycotaxon 29: 267-283. In print.
-- 1987b. The genus *Protounguicularia* in Europe. Beiträge zur Kenntnis der Pilze Mitteleuropas 3. In print.
-- 1987c. A treatise of five glassy-haired Hyaloscyphaceae. Karstenia 27. In print.
-- 1987d. New Svalbard fungi. Pages 123-151 *in* G.A. LAURSEN & S.A. REDHEAD (eds.). Arctic and Alpine Mycology 2. Plenum Publishing Co. In print.
KORF, R.P. 1951. A monograph of the Arachnopezizeae. Lloydia 14: 129-180.
-- 1978. Revisionary studies in the Arachnopezizoideae: A monograph of the Polydesmieae. Mycotaxon 7: 457-492.
-- KOHN, L.M. 1980. Revisionary studies in the Hyaloscypheae. 1. On genera with "glassy" hairs. Mycotaxon 10: 503-512.
-- ZHUANG, W.-Y. 1985. Some new species and new records of discomycetes in China. Mycotaxon 22: 483-514.
MASSEE, G. 1895. British Fungus-Flora. 4. London. 522 p.
NANNFELDT, J.A. 1936. Notes on type specimens of British inoperculate discomycetes (First part, notes 1-50). Trans. Brit. mycol. Soc. 20: 191-206.

RAITVIIR, A. & GALAN, R. 1986. A new genus of the Hyaloscyphaceae. Int. J. mycol. lichenol. 2: 221-234.

RASCHLE, P. 1977. Taxonomische Untersuchungen an Ascomyceten aus der Familie der Hyaloscyphaceae Nannfeldt. Sydowia 29: 170-236.

SVRČEK, M. 1977. New or less known Discomycetes 6. Česka Mykol. 31: 193-200.

-- 1979. New or less known Discomycetes. 10. Česka Mykol. 33: 193-206.

-- 1983. New or less known Discomycetes. 12. Česka Mykol. 37: 65-71.

-- 1985. Notes on the genus *Hyaloscypha* (Helotiales). Česka Mykol. 39: 205-219.

MYCOTAXON

Vol. XXX, pp. 29-37 October-December 1987

NOTES ON HYPHOMYCETES. LIV. CONCERNING PITHOMYCES CLAVISPORUS, A NEW SPECIES, P. GRAMINICOLA AND P. PAVGII

GARETH MORGAN-JONES

Department of Plant Pathology, College of Agriculture and Alabama
Agricultural Experiment Station, Auburn University, Auburn, Alabama 36849

ABSTRACT

A new species of *Pithomyces* Berk. & Br., *P. clavisporus* Morgan-Jones, isolated from air in Alabama, is described and illustrated, as is *P. graminicola* R.Y. Roy & Rai, with which it is compared. *Pithomyces pavgii* (Nath) Palm, Stewart & Rossman is considered to be conspecific with the latter. Several isolates of *P. graminicola*, including one obtained recently from an Alabama peanut field soil, show it to be morphologically variable.

INTRODUCTION

During the past year, two interesting isolates of *Pithomyces* Sacc. have been encountered in Alabama, one from air, the other from peanut field soil. The former has been determined to represent a hitherto undescribed species and is named *P. clavisporus* Morgan-Jones herein, while the latter has been identified as *P. graminicola* R.Y. Roy & Rai. In the course of examining these fungi it has again become apparent that considerable phenotypic plasticity, as reflected by variability in conidial morphology, exists among species of *Pithomyces*. This has previously been documented to occur in a number of species and results in some difficulty in circumscribing taxa. For example, Ellis (1960) noted variability in shape among conidia of *P. sacchari* (Speg.) M.B. Ellis, and his illustrations of that species and of *P. cynodontis* M.B. Ellis (Ellis, 1965) show differences in septation as well. Hughes (1953) refrained from defining species among certain elements of the genus, for which the name *Sporidesmium bakeri* Syd. [= *Pithomyces chartarum* (Berk. & Br.) M.B. Ellis] was collectively used. He described a number of collections, made in Ghana [then the Gold Coast], representing several currently accepted separate taxa, as varieties of *S. bakeri*. These included the species subsequently named *P. africanus* M.B. Ellis, *P. sacchari* [fide Ellis, 1960] and *P. maydicus* (Sacc.) M.B. Ellis, in addition to *P. chartarum*. The fact that species in *Pithomyces* are sometimes difficult to define is further illustrated by the fact that Dingley (1962) considered *P. maydicus* conspecific with *P. chartarum*. Ellis (1960) had described these as being separate and distinguishable. The difference between them lies in the former having paler conidia that are less septate than those of the latter.

Alabama Agricultural Experiment Station Journal Series No. 18-871272.

In attempting to name the isolate from Alabama field soil, the binomial *Pithomyces pavgii* (Nath) Palm, Stewart & Rossman [= *Pithomyces funiculosus* (as *funiculosa*) Palm, Stewart & Rossman] had to be considered in addition to *P. graminicola* because of similar conidial morphology between the two. Palm *et al.* (1979), when describing *P. funiculosa*, noted that it resembled *P. graminicola* but differed in having larger, verrucose conidia and frequently funiculose conidiophores. When Palm *et al.* (1979) established the name *P. funiculosa* they were unaware that Nath (1979) had, three months earlier, proposed the binomial *Trichocladium pavgii* Nath for the same fungus. In a subsequent publication, Palm and Stewart (1981) recognized this but considered *Trichocladium* Harz to be an inappropriate genus for it, partly because of rhexolytic detachment of conidia. They accordingly transferred *T. pavgii* into *Pithomyces* and listed *P. funiculosa* as a synonym.

Pithomyces graminicola appears to have been first described by Hughes (1953) under the name *Sporidesmium bakeri* var. I (Matsushima, 1980) although Ellis (1960) listed Hughes' designation and material under the name *Pithomyces sacchari*. Matsushima (1980), based on collections made in Taiwan from three different hosts and isolated in pure culture, showed the species to be highly variable and conidial morphology *in vitro* to be quite different from that on natural substrates. The isolate from Alabama soil shows similar variability when grown on different agar media. Conidia produced on chitin agar are essentially identical to those figured by Matsushima on V-8 juice agar. A comparison of this isolate with one previously obtained from municipal waste water in Alabama and identified as *P. pavgii* [examined and confirmed as such by Palm and Stewart (1981)] has led me to believe that that species is the same as *P. graminicola*. Additional studies of the type material of *P. funiculosa*, *P. graminicola*, and *P. pavgii*, and of an isolate of *P. graminicola* from wheat rhizosphere, identified by M.B. Ellis and deposited at ATCC by K. Sivasithamparam, has confirmed this opinion. To facilitate correct identification of *P. graminicola*, given its variability, a detailed description of its characteristics *in vitro* is provided in addition to a treatment of *P. clavisporus*.

TAXONOMIC PART

Pithomyces clavisporus sp. nov. (Figure 1).

Coloniae in agaro decocto tuberorum cremeae vel fulvae, lanosae vel coactae; reverso concolori vel pallide brunneo. Mycelium ex hyphis septatis, hyalinis, subhyalinis vel pallide brunneis, ramosis, levibus vel verrucosis, laxe reticulatis, 1.5-4 um crassis compositum. Conidiophora micronemata, mononemata, singula ex apice lateribusque hypharum oriunda, recta vel flexuosa, cylindrica, laevia, 8-29 um longa, 2-2.5 um crassa. Cellae conidiogenae monoblasticae. Conidia holoblastica, singula in apice conidiophore oriunda, recta vel leniter curvata, clavata, 0-4-septata, plerumque 2-septata, brunnea, laevia vel verruculosa, ad septa nonconstricta, 13-24 (29) um longa, 5-7 um crassa, apicem versus obtusum decrescentes, ad basim truncata, margine cicatrice fimbriata praedita.

Isolatus ex aere, Auburn, Lee County, Alabama, September 16, 1986, G. Morgan-Jones, AUA, holotypus.

Colonies on potato dextrose agar [Difco] at first whitish to cream-colored,

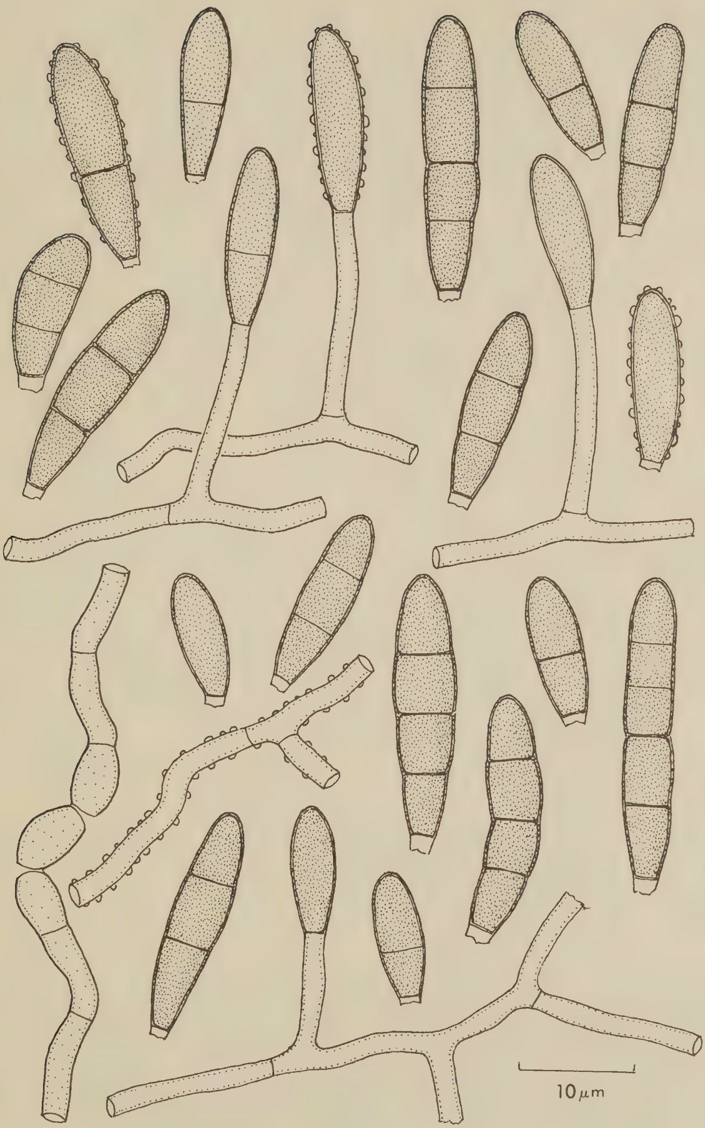


FIGURE 1. *Pithomyces clavisporus*. Hyphae, conidiophores, and conidia.

becoming buff with age, lanose or felted; reverse colorless or becoming pale brown. Mycelium composed of hyphae of two types: hyaline, septate, branched, smooth or verrucose, 1.5-2 um wide, forming a loose network and bearing conidiogenous cells; and subhyaline to pale brown, septate, branched, smooth, 2-4 um wide, with individual cellular elements sometimes slightly inflated and disarticulating in the manner of arthroconidia in older cultures. Conidiophores micronematous, mononematous, arising terminally or as lateral branches of the hyphae (lateral fertile conidiogenous element sometimes not delimited from the parent hypha by a transverse septum), straight or slightly flexuous, cylindrical, smooth, 8-29 um long, 2-2.5 um wide. Conidiogenous cells monoblastic. Conidia holoblastic, produced singly as blown out ends of conidiogenous cells, straight or, less frequently, slightly curved, clavate, 0-4-septate, predominantly 2-septate, brown, smooth or verruculose or, rarely, tuberculate, not constricted at the septa (in older cultures some may become slightly constricted), detached rhexolytically, 13-24 (29) um long, 5-7 um wide, tapering to an obtuse apex, truncate at the base and bearing a conspicuous frill derived from the portion of the apex of the conidiogenous cells immediately subtending the conidium-delimiting septum.

In air; North America.

Collection examined: Auburn, Lee County, Alabama, September 16, 1986, G. Morgan-Jones, AUA, type.

The conidia of *P. clavisporus* are similar in shape to those of *P. africanus* but, although overlapping in size, are generally longer and more septate. The conidia of *P. africanus* are dark blackish brown in color, much darker than those of *P. clavisporus*, and predominantly unicellular. *Pithomyces clavisporus* differs from *P. graminicola* in two respects. Its conidia are appreciably narrower and its conidiogenous cells are mostly discrete as lateral branches of the hyphae rather than integrated as hyphal elements with very short fertile lateral extensions as is common in *P. graminicola*. It is also somewhat less variable in its conidial morphology than is *P. graminicola*.

Pithomyces graminicola R.Y. Roy & Rai, *Trans. Br. mycol. Soc.* 51: 154, 1968 (Figure 2, Plate 1, A-F).

= *Pithomyces funiculosus* (as *funiculosa*) Palm, Stewart & Rossman, *Mycotaxon* 10: 246, 1979.
= *Pithomyces pavgii* (Nath) Palm, Stewart & Rossman, *Mycotaxon* 13: 465, 1981.
    ≡ *Trichocladium pavgii* Nath, *Sydowia* 31: 123, 1978.

Colonies on potato dextrose agar [Difco] grown at 25C attaining a diameter of 35 mm after 7 days, variable, lanose to somewhat funiculose, dense, at first whitish to cream-colored, becoming pale ochraceous buff to olivaceous, with a 2 mm wide white margin, after 14 days zonate with dark and pale alternating olivaceous bands, center usually assuming a chocolate brown coloration with age; reverse pale to dark olivaceous gray, zonate, center generally paler, sometimes becoming olivaceous black towards the periphery. Colonies on PDA grown at 30C attaining a diameter of 40 mm after 7 days, felted, with a smoother appearance than when grown at 25C, at first whitish, becoming pale olivaceous, after 14 days with one or more dark olivaceous bands towards the periphery, extreme center ochraceous, with a surrounding, 4 mm wide brownish to rust-colored

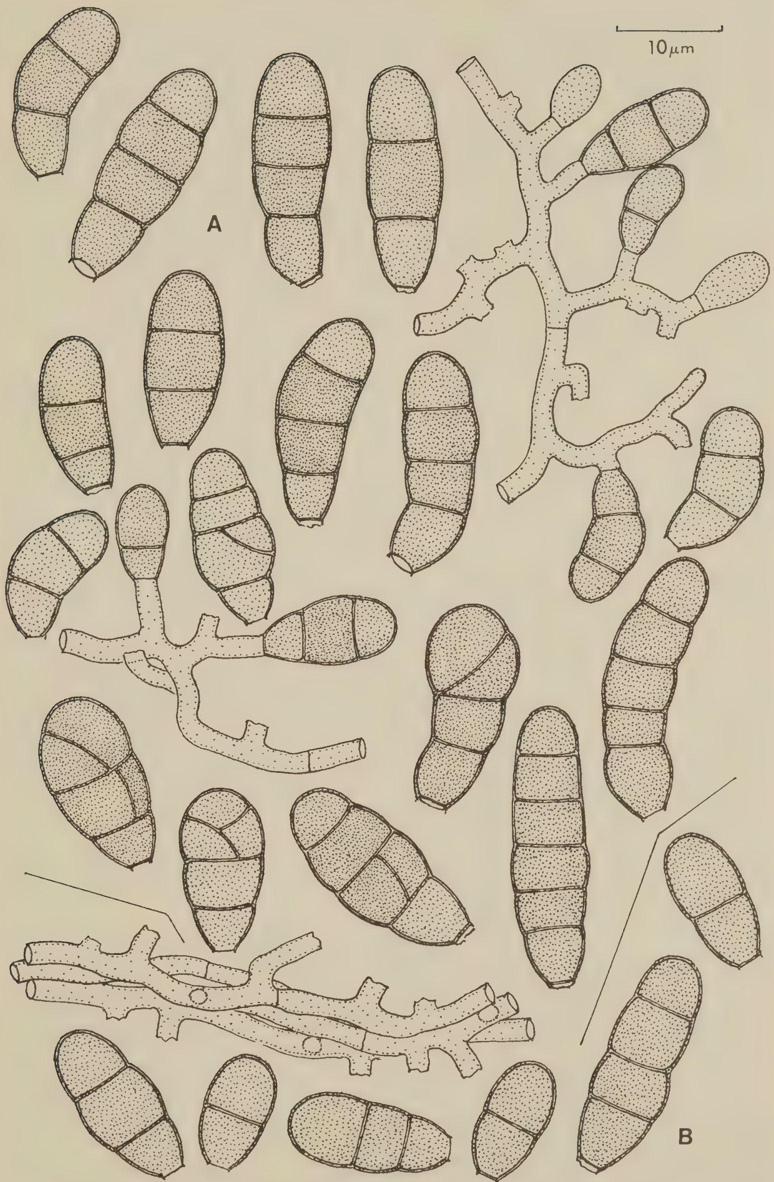


FIGURE 2. *Pithomyces graminicola* (Alabama soil isolate). A, Conidia and conidiophores on chitin agar; B, same on PDA.

zone, reverse appreciably paler than at 25C but with center darker. Conidiation more abundant at 30C than at 25C. Colonies on chitin agar [Godoy *et al*. (1982)] thin, with sparse aerial mycelium, white, tufted, producing localized, scattered clusters of conidia which appear as black, irregular, sometimes linear and radial, specks (Plate 1, C: indicated by arrowheads); reverse pale olivaceous. Mycelium composed of hyphae of two types: hyaline, septate, abundantly branched, anastomosing, reticulate, smooth, 1.5-2.5 um wide; and subhyaline to pale brown, more sparsely branched, smooth or, rarely, verruculose, frequently funiculose forming strands, 2.5-5 um wide. On chitin agar most hyphae produced are of the former type. On PDA pigmented hyphal strands copious, especially in older colonies, giving them a somewhat striated appearance in reverse. Conidiophores micronematous, mononematous or synnematous (as fertile hyphal strands), as hyphae or lateral branched thereof, cylindrical, where a lateral element, 2-8 um long. Lateral fertile extensions produced from wider pigmented hyphae generally short and appearing as stubs following conidial detachment; those produced from narrower, hyaline hyphae longer. Conidiogenous cells monoblastic, discrete or integrated as hyphal units bearing very short lateral fertile extensions. Conidia holoblastic, very variable in size, shape and septation, produced singly as blown out ends of conidiogenous cells, straight or slightly curved, ellipsoid, obovoid or broadly clavate, mostly smooth, sometimes verruculose, pale yellowish brown to brown, transversely 1 to 5-septate, and sometimes with 1 or 2 transverse or oblique septa, usually slightly constricted at the septa, detached rhexolytically, 7-20 (31) um long, 4-10 (12) um wide, obtuse at the apex, truncate at the base, with a small circumscissile marginal frill.

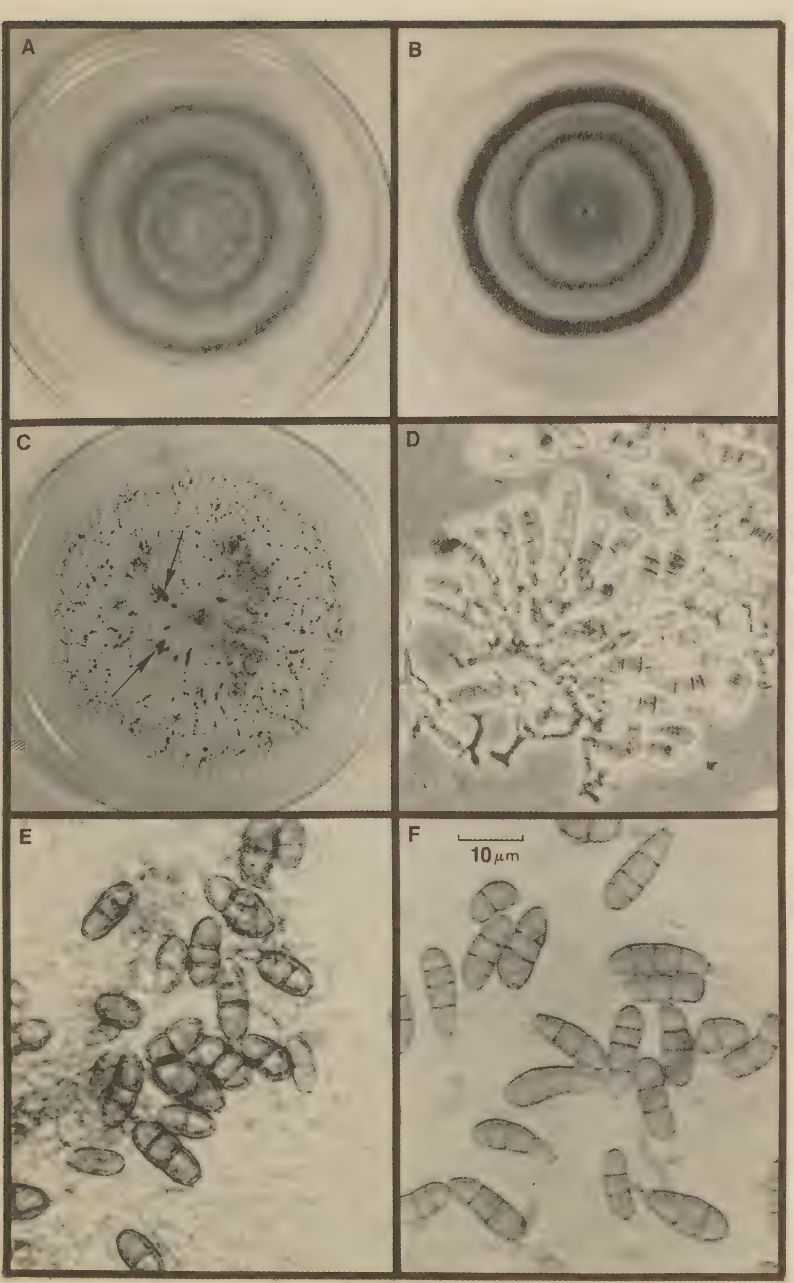
In kernels of peanut (*Arachis hypogaea* L.), mounds of *Macrotermes ukuzii* Fuller, on leaves and stipes of various plants (species of *Borassus* L., *Canna* L., *Phyllostachys* Sieb. & Zucc., *Ravenala* Adans., *Saccharum* L.), in soil and municipal waste water; Africa, India, North America, Taiwan.

Collections examined: on dead leaves of *Saccharum munja* Roxb., Banaras Hindu University campus, Varanasi, India, August 1966, B. Rai, IMI 126508 (type of *P. graminicola*); from kernels of *Arachis hypogaea*, Hyderabad, Rajendranagar, India, V.R. Nath, January 3, 1973, IMI 205718 (type of *P. pavgii*); from wheat rhizosphere, Western Australia, K. Sivasithamparam, ATCC 26151 (accessioned August 27, 1973); from fungal comb in mounds of *Macrotermes ukuzii*, Luyengo, Swaziland, September 15, 1977, A.Y. Rossman, MPPD, ATCC 42411 (type of *P. funiculosa*); from municipal waste water, Chambers County, Alabama, U.S.A., May 5, 1980, G. Morgan-Jones, AUA; from peanut field soil, Headland, Henry County, Alabama, U.S.A., March 30, 1987, G. Morgan-Jones and K.B. Burch, AUA.

DISCUSSION

As alluded to above, *P. graminicola* appears to vary considerably in morphology depending upon growing conditions. In nature, judging from published descriptions (Hughes, 1953; Roy and Rai, 1968; Matsushima, 1980), and exam-

PLATE 1. *Pithomyces graminicola* (Alabama soil isolate.) A, 14-day-old colony on PDA; B, reverse of same; C, 21-day-old colony on chitin agar (conidial clusters indicated by arrows); D, conidiophores and developing conidia on chitin agar; E, conidia on chitin agar; F, conidia on PDA at 30C.


A
B
C
D
E
F
10 μm

ination of the type material, conidia have predominantly two to three transverse septa. In the type, which is somewhat depauperate, the conidia are fairly small [7-13 X 4-7 um], with 0 to 2 transverse, but no longitudinal septa [Roy and Rai (1968) gave conidial measurements of 12-20 X 4.5-9 um and Marasas and Schumann (1972), who also examined the type, gave 7-12 X 4-6 um (mostly 9 X 5 um)]. In culture on agar media, degree of septation is far less constant and longitudinal and/or oblique septa are common. On PDA in this study, and on malt agar (Palm *et al.*, 1979, and Palm and Stewart, 1981), the conidia were more similar to those found in nature than those produced on V-8 juice agar (Matsushima, 1980) and chitin agar. Those produced on the latter medium approximate in morphology conidia of *P. sacchari*, although they do not become as dark brown as they normally do in that species. End cells of phragmosporus conidia on chitin agar are generally slightly paler than are median cells. Conidia in older cultures frequently have reduced cell lumina, giving the appearance of being distoseptate. The difference between these and those produced in young cultures is similar to that described by Swart (1985) for *Corynespora acaciae* Swart at various stages of maturity. Conidia produced on PDA, particularly at 30C, are pale golden brown in color, whereas those on other media tend to be darker. At 30C on PDA, conidia produced are also appreciably thinner-walled (Plate 1, F). Conidial size and wall ornamentation is also variable. Conidia produced on chitin agar are larger, frequently wider (giving an obovate shape), and have more longitudinal and oblique septa than those produced on other media. Conidial wall roughening occurs irregularly. Arrangement of fertile hyphae in a funiculose manner varies according to cultural conditions. This phenomenon occurs commonly on PDA but only sporadically on chitin agar. Colonies grown on PDA at 25C at first sporulate sparsely, but can readily be stimulated to increase conidial production by exposure to near ultra-violet light. Monoconidial subisolates of the Alabama peanut field soil strain vary substantially in their cultural characteristics and in their capacity to produce conidia. On PDA at 25C, colonies of some remain creamish-buff and produce no dark olivaceous bands while the majority become distinctly zonate. Some subisolates, when grown on chitin agar, produce few, if any, conidia, while others produce them abundantly on this medium.

Marasas and Schumann (1972) reported experiencing considerable difficulty in identifying three South African isolates of *Pithomyces*. One was determined to be *P. chartarum*, one to be *P. sacchari*, and one was described as a new species, *P. karoo* Marasas & Schumann. That named *P. sacchari*, judging from the description, was essentially similar to *P. graminicola* as understood here. When grown on malt extract and potato-carrot agars, it produced conidia that most closely resembled those of *P. graminicola* in having smooth walls. Comparison with the type, however, led the authors to conclude that their isolate was different. Following consultation with Dr. M.B. Ellis, who reported growing the isolate on oat-meal agar and obtaining conidia with rough walls that were longitudinally as well as transversely septate, the isolate was determined to be *P. sacchari*. In view of the variation found in the present study, the South African isolate named *P. sacchari* might be more appropriately named *P. graminicola*. The distinction between *P. graminicola* and *P. sacchari* is, however, also problematic. Roy and Rai (1968), in their original treatment of *P. graminicola*, stated that the conidia of that species resembled those of *P. sacchari*, differing only by having smooth walls and few or no longitudinal septa. It seems possible that a continuum exists in this whole complex and that only one binomial can be applied to it with confidence. If this is found to be the case, following further *in vitro* studies of variability, the name *Pithomyces sacchari*

[≡ *Sporidesmium sacchari* Speg., *An. Mus. nac. B. Aires* 20: 443, 1910] has priority.

ACKNOWLEGMENTS

I thank Dr. B.C. Sutton, CAB International Mycological Institute, Kew, Surrey, United Kingdom, for making type specimens of *P. graminicola* and *P. pavgii* available for study. I have had the benefit of consultation with Dr. Mary E. Palm, Animal and Plant Health Inspection Service, USDA, Beltsville, Maryland, for which I am grateful. Dr. Donald P. Rogers, Auburn, Washington, offered advice concerning the Latin diagnosis. Thanks are also due Dr. Roger D. Goos, Department of Botany, University of Rhode Island, for reviewing the manuscript.

LITERATURE CITED

DINGLEY, J.M. 1962. *Pithomyces chartarum*, its occurrence, morphology, and taxonomy. *N.Z. J. agric. Res.* 5: 49-61.
ELLIS, M.B. 1960. Dematiaceous Hyphomycetes. I. *Mycol. Pap.* 76: 1-36.
ELLIS, M.B. 1965. Dematiaceous Hyphomycetes. VI. *Mycol. Pap.* 103: 1-46.
GODOY, G., R. RODRIGUEZ-KABANA and G. MORGAN-JONES. 1982. Parasitism of eggs of *Heterodera glycines* and *Meloidogyne arenaria* by fungi isolated from cysts of *H. glycines*. *Nematropica* 12: 111-119.
HUGHES, S.J. 1953. Fungi from the Gold Coast. II. *Mycol. Pap.* 50: 1-104.
MARASAS, W.F.O. and I.H. SCHUMANN. 1972. The genus *Pithomyces* in South Africa. *Bothalia* 10: 509-516.
MATSUSHIMA, T. 1980. Saprophytic microfungi from Taiwan. Part 1. Hyphomycetes. *Matsushima Mycol. Mem.* 1: 1-82.
NATH, V.R. 1979. On *Trichocladium* and a new species, *Trichocladium pavgii*. *Sydowia* 31: 122-125.
PALM, M.E. and E.L. STEWART. 1981. *Pithomyces pavgii*, a new combination for *Trichocladium pavgii* and *Pithomyces funiculosa*. *Mycotaxon* 13: 465-468.
PALM, M.E., E.L. STEWART, and A.Y. ROSSMAN. 1979. *Pithomyces funiculosa* sp. nov. from fungal comb of *Macrotermes ukuzii* in Swaziland. *Mycotaxon* 10: 246-250.
ROY, R.Y. and B. RAI. 1968. New species of *Lacellina* and *Pithomyces*. *Trans. Br. mycol. Soc.* 51: 152-155.
SWART, H.J. 1985. Australian leaf-inhabiting fungi. XVIII. *Corynespora acaciae* sp. nov. *Trans. Br. mycol. Soc.* 84: 175-177.

MYCOTAXON

Vol. XXX, pp. 39-68 October-December 1987

THE TAXA OF USNEA (LICHENES) DESCRIBED BY MICHAUX FROM EASTERN NORTH AMERICA

ISABELLE I. TAVARES

Department of Botany, University of California
Berkeley, California 94720

SUMMARY

A comparison is made of Usnea strigosa (Ach.) A. Eaton, U. tristis Motyka, U. evansii Motyka, and U. endochrysea Stirton with the three taxa of short, apotheciate Usnea described by Michaux, for which 2 new combinations and a new name are being established (U. strigosa [Ach.] A. Eaton subsp. **rubiginea** [Michx.] comb. nov., U. strigosa [Ach.] A. Eaton subsp. **major** [Michx.] comb. nov., and U. **michauxii** nom. nov. [syn. U. florida var. intermedia Michx.]).

When Michaux described the three taxa of short, fertile Usnea that he found in eastern North America between 1785 and 1795, he made them varieties of U. florida (L.) Wigg., the short, erect, apotheciate Usnea that had been described from Europe. His posthumous publication appeared in 1803, the same year in which Acharius published a description of U. florida var. strigosa Ach., a similar taxon from the Western Hemisphere.

Michaux (1803) characterized his taxa as follows: U. florida var. major Michx. (from "Carolina") had pallid, yellowish apothecia, whereas those of U. florida var. intermedia Michx. (also from "Carolina") were small and cinereous and those of U. florida var. rubiginea Michx. (from Canada) were concolorous with the more compact thallus, which was reddish in color. Usnea florida var. intermedia was described as being smaller and more divaricate than U. florida var. major. A sheet bearing these three taxa in the order of their appearance in Michaux's publication was found in the Herbarium Hue (Herbarium Richard), Paris Museum of Natural History cryptogamic collections. The sheet had been labelled with the locality for each taxon; at the top had been written Usnea florida and later strigosa (fig. 1)(none of the notations appear to have been written by Michaux). Michaux's names were not present. However, the arrangement of the specimens, as well as their characteristics, indicate that they are part of the type collections. Because no other material has been located, lectotypes have been selected from this sheet.

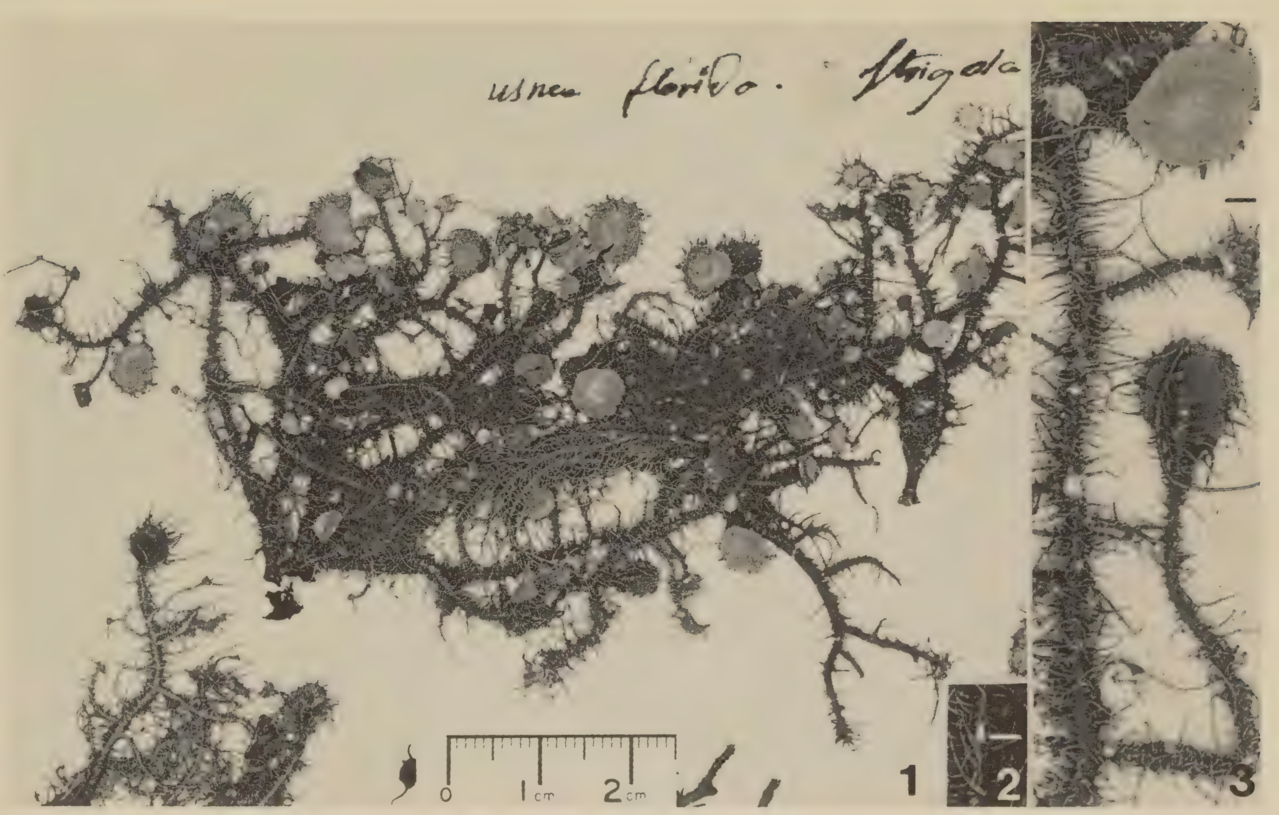
When he described *U. florida* var. *strigosa*, Acharius (1803) mentioned its abundance of short, straight ramuli (fibrils) and pallid, flesh-colored ("carneo-pallidus") apothecia. The locality was given as North America and the collector as O. Swartz, who collected extensively in Jamaica. Later, Acharius (1810) listed the collection locality as Jamaica. Although the specimen of *U. florida* var. *strigosa* in the Acharius Herbarium at Helsinki is labelled "Jamaica," it probably was collected by Swartz near Boston, Massachusetts, during his stay there in the autumn of 1783 (Santesson, personal communication; see also Howard and Bremer, 1982). This specimen was accepted by Motyka (1936-1938) as the type (no material exists in the Swartz collection at Stockholm [Santesson, personal communication]). Motyka (1936-1938) thought it unlikely that the specimen had come from Jamaica, reporting no other collections from the West Indies. I have seen none from that area in herbaria.

Most short, strigose, fertile thalli from eastern North America have been referred to this taxon, now known as *U. strigosa* (Ach.) A. Eaton, 1829 (cf. Hale, 1962; Moore, 1968). By contrast, the taxa described by Michaux have been overlooked by almost all subsequent authors (although they were placed in synonymy with *U. florida* [L.] Wigg. by Howe [1915]), with the exception of *U. florida* var. *rubiginea*.

Tuckerman (1847) erroneously referred lax, scabrous, rusty reddish specimens in North America to *U. barbata* var. *rubiginea* (Michx.) Tuck.; he made no mention of apothecia. Subsequent authors have followed his example (when they actually distinguished taxa from the Linnaean species). One such author was Herre (1910), who remarked that apothecia were lacking in specimens of *U. rubiginea* (Michx.) Mass. that he examined. James (1979) pointed out that European thalli previously called *U. rubiginea* should be referred to *U. rubicunda* Stirton. (The latter name can be applied to many North American collections, as well, that are also colored by numerous orange-red cortical cells [see Tavares and Baltzo, 1977].)

Usnea rubiginea is being made a subspecies of *U. strigosa*. However, its relatively narrow axis (figs. 4, 22, 18), thick, hard cortex, and strongly inflated apothecial cilia (fig. 22) and ramuli, as well as the closely spaced long, lateral branchlets, clearly

Figs. 1-3. *Usnea strigosa* subsp. *major*. 1. Lectotype with portions of smaller thalli, showing apothecia terminal on large branches as well as those terminating short, lateral branches. (The lectotype is the large specimen extending upward and to the right from the dark holdfast mid-lower left; it is overlain by some small thalli at upper right and left and at mid-right.) 2. Portion of lectotype showing relative width of white axis. White line terminates at outer edge of cortex of branchlet. (For magnification, see line near top of fig. 3, which indicates 1 mm.) 3. Long branch of lectotype, showing arrangement of short, lateral apotheciate branchlets and ramuli of various lengths.

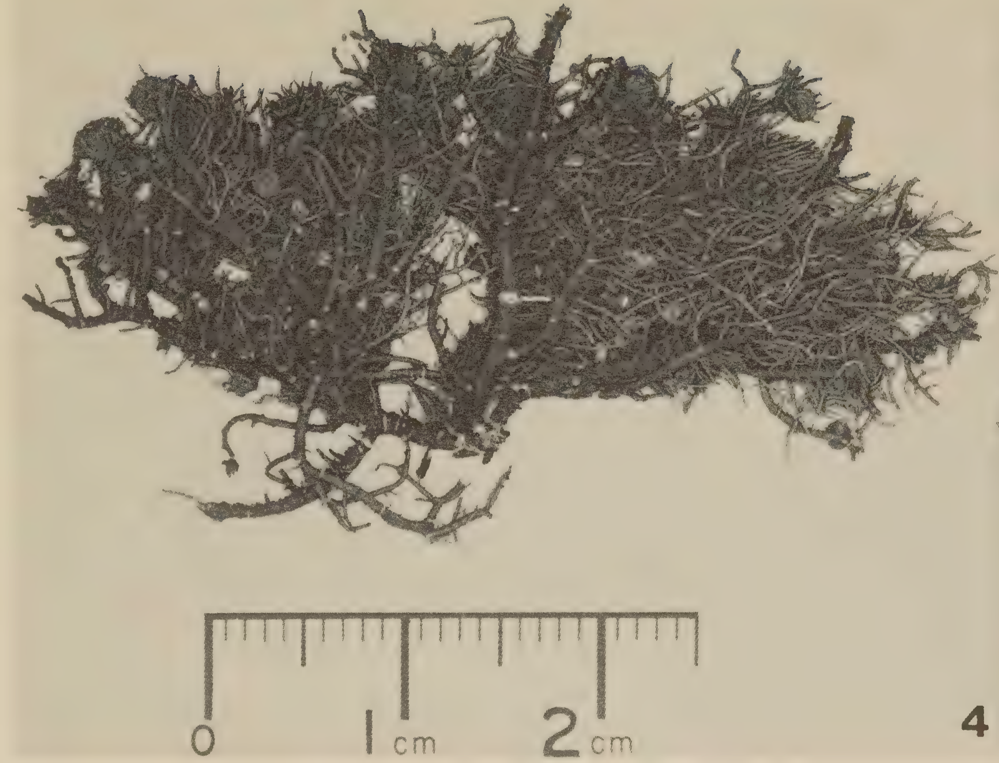

usnea florida · ſtrigoſa
0
1 cm
2 cm
1
2
3

distinguish it. The cortex, axis, and medulla of *U. strigosa* subsp. *strigosa* are moderate in width (figs. 9, 15, 20), like those of *U. florida* var. *major* (figs. 2-3, 16). The inflated ramuli, dark color, and extensive broad-papillate areas of ***U. strigosa*** subsp. ***rubiginea*** are reminiscent of those of *U. tristis* Mot. (fig. 28), which has a thinner cortex (see Motyka, 1936-1938). The branches of *U. evansii* Mot. tend to be quite angular in places, the "papillae" are quite narrow even though the ramuli growing from them are inflated and broad, and both the cortex and the axis are thin (figs. 19, 27).

Usnea florida var. *major* and *U. strigosa* subsp. *rubiginea*, like *U. strigosa* subsp. *strigosa*, lack the strongly blackened base of typical European *U. florida* (fig. 29). In addition, the "papillae" that emerge from the cortex of the branches are quite frequent. These "papillae" are incipient ramuli; they later extend outward into conical ramuli, which lengthen, become more cylindrical, and sometimes crack at the junction with the peglike bases, which have thicker, rougher cortex. The branches of *U. florida* var. *major* are crowded with ramuli that typically are arranged in an alternating pattern of several short ramuli separated by longer ramuli or short branchlets. New ramuli are being formed continually. The strigose appearance of the elongate, divergent branches, as well as the absence of a black base, clearly distinguish *U. florida* var. *major* from typical *U. florida* (fig. 29). Like *U. strigosa* subsp. *strigosa*, *U. florida* var. *major* has a medulla that is usually partly reddish, not constantly white like that of European *U. florida*. *Usnea florida* var. *major* is being transferred to *U. strigosa* and raised to subspecific level. The gray-green color of *U. strigosa* subsp. *strigosa* is more persistent (the thalli remain dark in color), the ramuli are sparser, the branches more irregularly curved (figs. 9, 11, 20; cf. fig. 21), and the lumina of the cortical cells are considerably wider (ca. 2-5 um; cf. figs. 12, 14) than in *U. strigosa* subsp. *major* (1-2 um; fig. 12). *Usnea endochrysea* has wider cortical cell lumina and a more delicate and complex branching system than *U. strigosa* subsp. *major*, and it is also distinguished by the more irregular arrangement of ramuli and branchlets, the thinner, more fragile cortex, and the thinner axis (fig. 26).

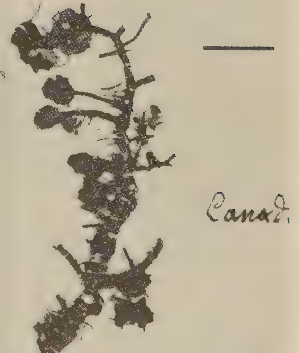
Usnea florida var. *intermedia* is separated from the taxa mentioned above by the thin, smooth cortex, narrow axis (fig. 24), very lax but cottony white medulla, sharply raised, thin tubercles on the apothecial stalks

Figs. 4-6. *Usnea strigosa* subsp. *rubiginea*. 4. Caespitose young isolectotype, showing closely spaced long, lateral branchlets and ramuli. White line in center reaches right edge of cortex at cut exposing medulla; axis and cortex are relatively narrow in this inflated main branch. 5. Lectotype having several long lateral branchlets close together (for magnification, see line on fig. 6, which indicates 1 cm). 6. Second isolectotype on sheet, in poor condition.



4

5



6

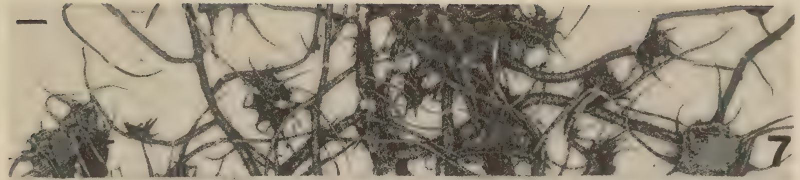
(stipes), lightly foveolate branches (fig. 25), and sparse, long ramuli that are often inflated just above a break near the base. Apparently, dark red spots (discolored black in the type) are always present. Consequently, U. florida var. intermedia should be treated as a distinct species and is hereby given the name **U. michauxii** nom. nov., because the binomial U. intermedia cannot be used (U. intermedia Jatta sensu Mot. [Motyka, 1936-1938] is an apotheciate European taxon having pendent, almost bare summits or branch apices emerging from a crowded mass of ramulose, papillate branches).

Usnea strigosa (Ach.) A. Eaton subsp. major (Michx.) comb. nov. (figs. 1-3, 16, 21)
U. florida (L.) Wigg. var. major Michaux, Flora Bor.-Am. 2: 332. 1803.
Lectotype: PC (Herb. Richard, Herb. Hue)(large thallus on upper left part of sheet). Type locality: 'Carolina.'

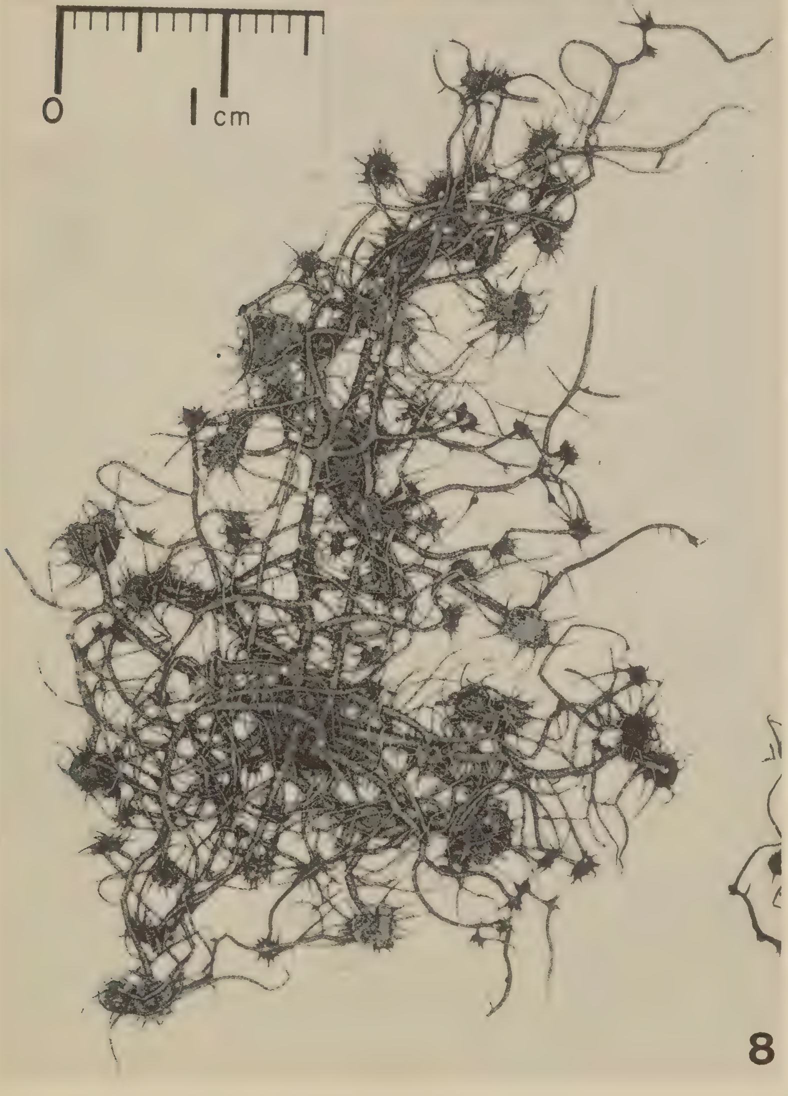
Lichen acids detected by thin-layer chromatography (Culberson and Kristinsson, 1970) and crystal tests (see Thomson, 1967)(crystals obtained by removing inconspicuous ramuli or already damaged branch tips or by pressing thallus firmly down on a glass coverslip; any noticeable alteration of the thallus form was avoided): usnic, norstictic acids. (Some material of this collection apparently contained thamnolic acid [Hale, personal communication].)

Characteristics of taxon are as follows. Color: clear gray green turning yellowish (fresh color, ca. yellowish glaucous to deep lichen green; in age, between deep olive buff and a pale light yellowish olive in Ridgway [1912])(pale areas may develop early, especially on new cortex at ends of segments of branches); sometimes with a blackish pruinosity; in the lectotype, color near amber brown on large branches, near Naples yellow on ramuli; disks of apothecia pale yellowish, becoming buff yellow; in the lectotype, disks near light ochraceous salmon to a pale russet (Ridgway, 1912). Form of thallus (based on lectotype): diverging branches arise just above base of thallus; along larger branches there are more or less regularly arranged ramuli of moderate length, between which arise "papillae" that grow apically into minute ramuli; branches are annulate-cracked at intervals, sometimes slightly constricted at ends of segments;

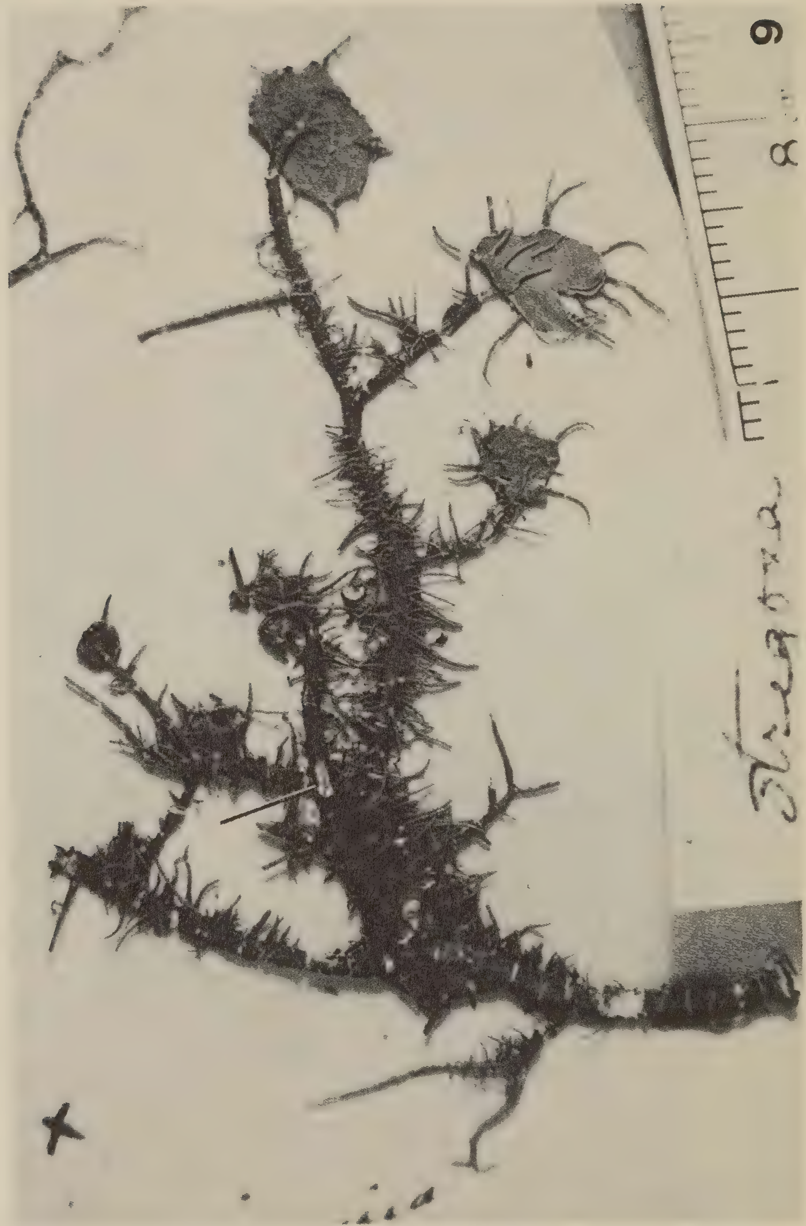
Figs. 7-8 (opposite page). Usnea michauxii, lectotype.
7. Enlarged portion of thallus with medulla exposed in vertical branch in center (line at left represents 1 mm). 8. Entire specimen with portion of isolectotype at right. Note loose branching pattern, long, bare apices of branches, and sparse ramuli.
Fig. 9 (following page). Usnea strigosa subsp. strigosa lectotype. Black-and-white line indicates cut in large branch exposing axis.



7



8


9
8

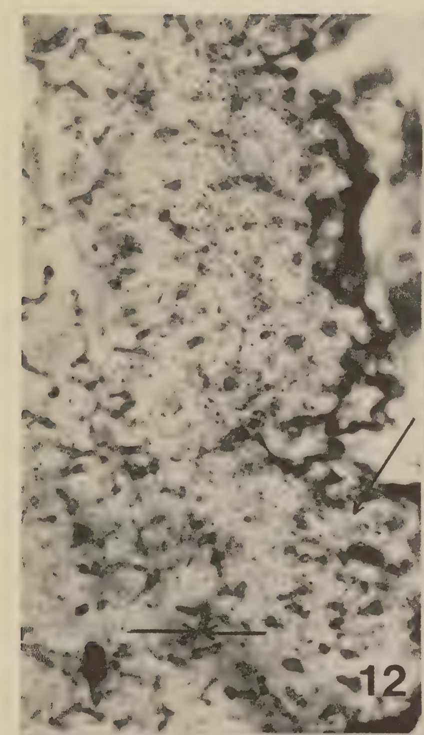
10

11

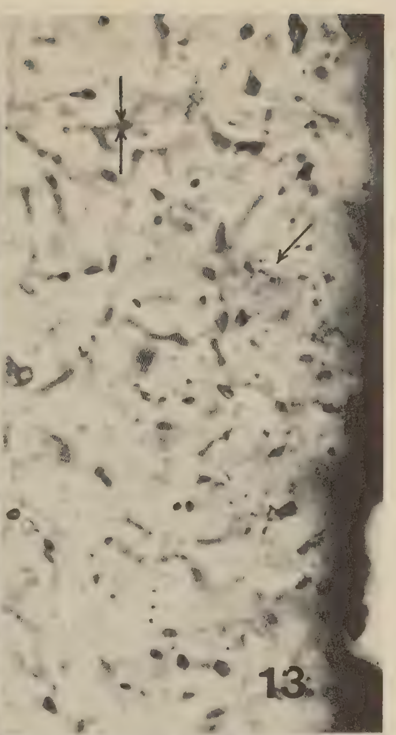
ramuli are gradually tapering, rarely inflated above annulate break near base. Anatomy (based on lectotype): cortex thick, rough or rimose on outside, glassy inside, with cortical cells ca. 12 um wide, the lumina ca. [1]1.5-2 um wide; medulla moderate in density, of entangled hyphae, usually red around axis or under cortex, white elsewhere; axis whitish to buff or reddish (cortex ca. 85-100 um thick, irregular inside, medulla ca. 200-225 [-325] um thick, axis ca. 175-200 [-400] um thick; CMA generally appears to be: 1:2:2); "papillae" ca. 80 um high, 75-90 um wide, marginal cilia of apothecia ca. 200 um wide at base; exciple rough, reticulate; spores ca. 7-8.75 x 5-5.5 um.

Range: Nova Scotia, Canada, to Florida, U.S.A., west to Louisiana and West Virginia. A few collections indicating the range of typical specimens follow: Canada: Nova Scotia, Yarmouth Co., near Lake George, on conifer, conifer-maple woods and bog, R. R. Ireland 12406, 31 July 1968 (CANL)(usnic and norstictic acids) (mixed with a different form having usnic and possibly psoromic acids); USA: New Jersey, Bergen Co., Closter, Coe F. Austin, 1866? (DS)(usnic, norstictic acids); West Virginia, Pocahontas Co., Cold Run, on live *Acer*, Fred W. Gray, 3 Jan. 1923 (MIN) (usnic, norstictic acids); Florida, Jackson Co., Florida Caverns State Park, 2 mi. n. of Marianna, Shirley C. Tucker 8536, 27 March 1970 (Shirley Tucker Herbarium)(usnic, norstictic acids), Bradford Co., Magnolia Lake State Park, along state highway 21 NE of Keystone Heights, on branches of *Quercus virginiana* Mill., in open shrub oak community, alt. 100 ft., Dana Griffin III 931, 2 Nov. 1969 (FSU) (usnic, thamnolic acids); Alabama, Lee Co., Loachapoka-Roxana road, on twigs of currant bushes in open areas, Isabelle Tavares 2450 (with Valera Brinson, Ralph Strength), 30 June 1973 (UC)(usnic, norstictic acids); Louisiana, Grant Parish, along US Hy. 71, 3 mi. E of Colfax, on oaks, Shirley Tucker 6624, 24 Oct. 1966 (Tucker Herbarium)(usnic, norstictic acids), Livingston Parish, ca. 4 mi. NNE of Port

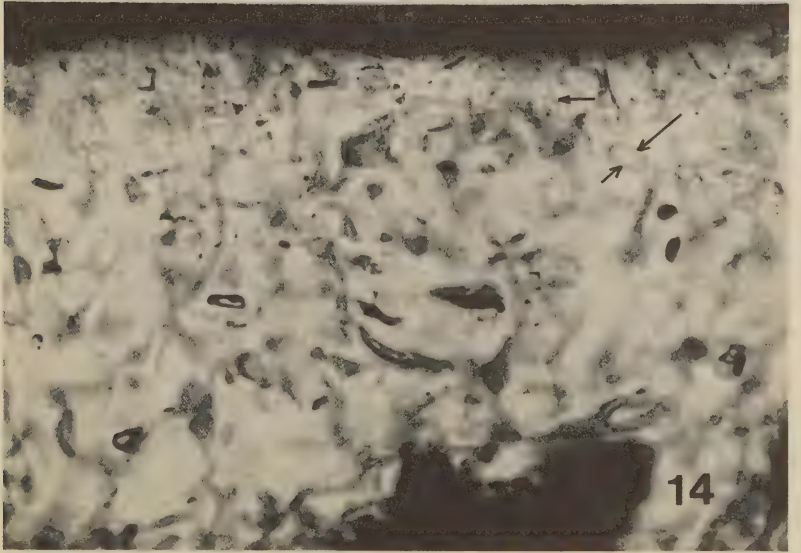
Figs. 10-11 (preceding page). *Usnea strigosa* subsp. *strigosa*. 10. Upper portion of thallus; note slender branch tips (line indicates 1 mm.). Budd's Lake, Sussex Co., New Jersey, John K. Small, 12-14 August 1890 (ex New York Botanical Garden)(UC 618813). 11. Entire specimen, showing irregular arrangement of ramuli (line represents 5 mm.). Purgatory Swamp, Norwood, Massachusetts, A. B. Seymour, 27 October 1900 (UC 795796).
Figs. 12-14 (opposite page). Cross-sections of cortices (cell lumina stained with cotton blue). X 600. 12. *Usnea strigosa* subsp. *major*, lectotype, showing dense granules (right arrow) in outer portion and narrow lumina (between two arrows below, center). 13. *U. strigosa* subsp. *rubiginea*, isolectotype, with fewer granules in outer portion (right arrow) and narrow lumina (width indicated by two arrows above left). 14. *U. strigosa* subsp. *strigosa*, lectotype; few granules are in outer part (upper arrow); lumina may be quite wide (a typical lumen lies between 2 arrows upper right).



12



13



14

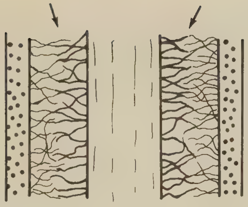
Vincent, on Quercus in low mixed woods, W. D. Reese & T. Morton 10210, 11 Nov. 1967 (Tucker Herb.)(usnic, psoromic acids). This taxon appears to be very common along the eastern seaboard. By contrast, U. strigosa subsp. strigosa seems to be rare.

Usnea strigosa (Ach.) A. Eaton subsp. rubiginea (Michx.) comb. nov. (figs. 4-6, 13, 18, 22-23)
U. florida (L.) Wigg. var. rubiginea Michaux, Flora Bor.-Am. 2: 332. 1803.
U. barbata (L.) Hoffm. var. rubiginea (Michx.) Tuckerman, Proc. Amer. Acad. Arts Sci. 1: 200. 1847.
U. rubiginea (Michx.) Mass. Mem. I. R. Istit. Veneto Sci. 10: 45. 1861.
Lectotype: PC (Herb. Richard, Herb. Hue)(middle thallus, base of sheet). Type locality: Canada.

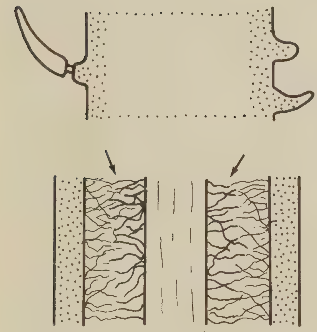
Lichen acids detected: usnic, norstictic, connorstictic (James, 1979).

Characteristics of taxon are as follows. Color (old): dull reddish discoloration over a dark olive color, which is probably close to the natural color in age. Form of thallus: when young, compact, fan-shaped, with numerous branches diverging just above base of thallus (fig. 4)(these main branches seem to separate easily in age--cf. figs. 5-6); branchlets mostly shiny, constricted at annulate breaks, densely covered with low "papillae" (apparently, the tendency of the "papillae" to extend into ramuli is much reduced); ramuli long, moderately wide, subnitid, irregularly dispersed in close groups, inflated above base; exciple of apothecium subnitid when young, reticulate, disk with dark pruina; marginal cilia inflated above base (figs. 4, 18). Anatomy: cortex thick, smooth (rimose on old portions), cortical lumina ca. 1-2 [-3] um wide (sometimes with red granules in type); medulla moderately dense, reddish; axis grayish (cortex ca. 200-225 um thick, medulla ca. 350 um wide; axis ca. 200-300 um wide); ramuli ca. 150-200 um wide, marginal cilia ca. 250-300 um wide where inflated; spores ca. 7.5 x 5 um. Range: although large

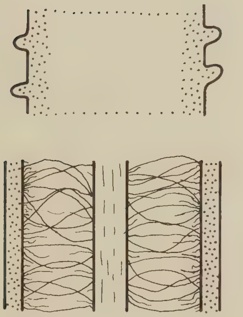
Figs. 15-19 (opposite page). Diagrams showing proportions of cortex, medulla, and axis in longitudinal section, as well as relative size and shape of "papillae" and ramuli; marginal apothecial cilium of Usnea strigosa subsp. rubiginea shown in fig. 18. Dark medullary lines represent area frequently filled with red hyphae (dividing line indicated by arrows). Absence of stippling in tips of ramuli indicates cortex is lighter in color. 15. U. strigosa subsp. strigosa, section. 16. U. strigosa subsp. major, section and surface view. 17. U. michauxii, section and surface. 18. U. strigosa subsp. rubiginea, section, surface, and cilium. 19. U. evansii, section and surface. Fig. 20 (following page). Usnea strigosa subsp. strigosa, Budd's Lake specimen, showing surface characteristics and axis in cut through cortex (arrow). Line, top center, to exposed axis; line, upper right, represents 1 mm.



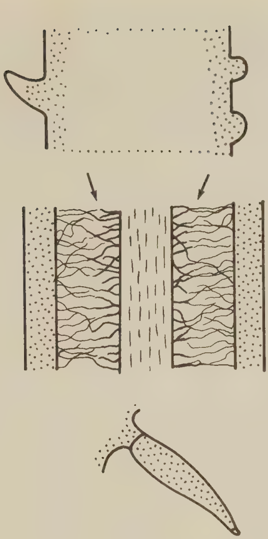
15



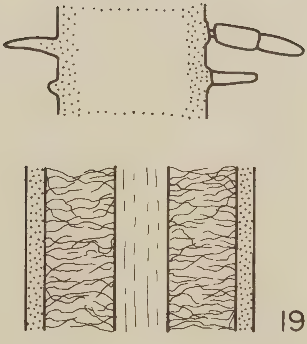
16



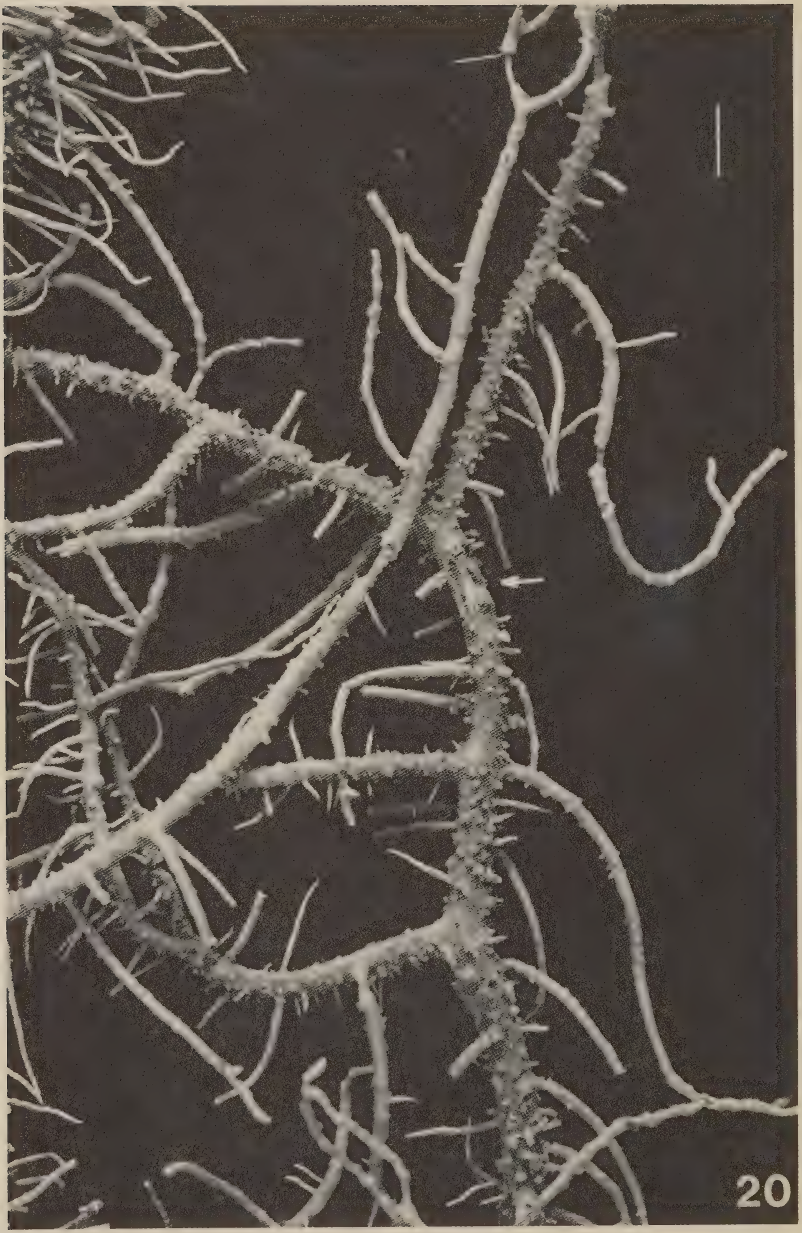
17

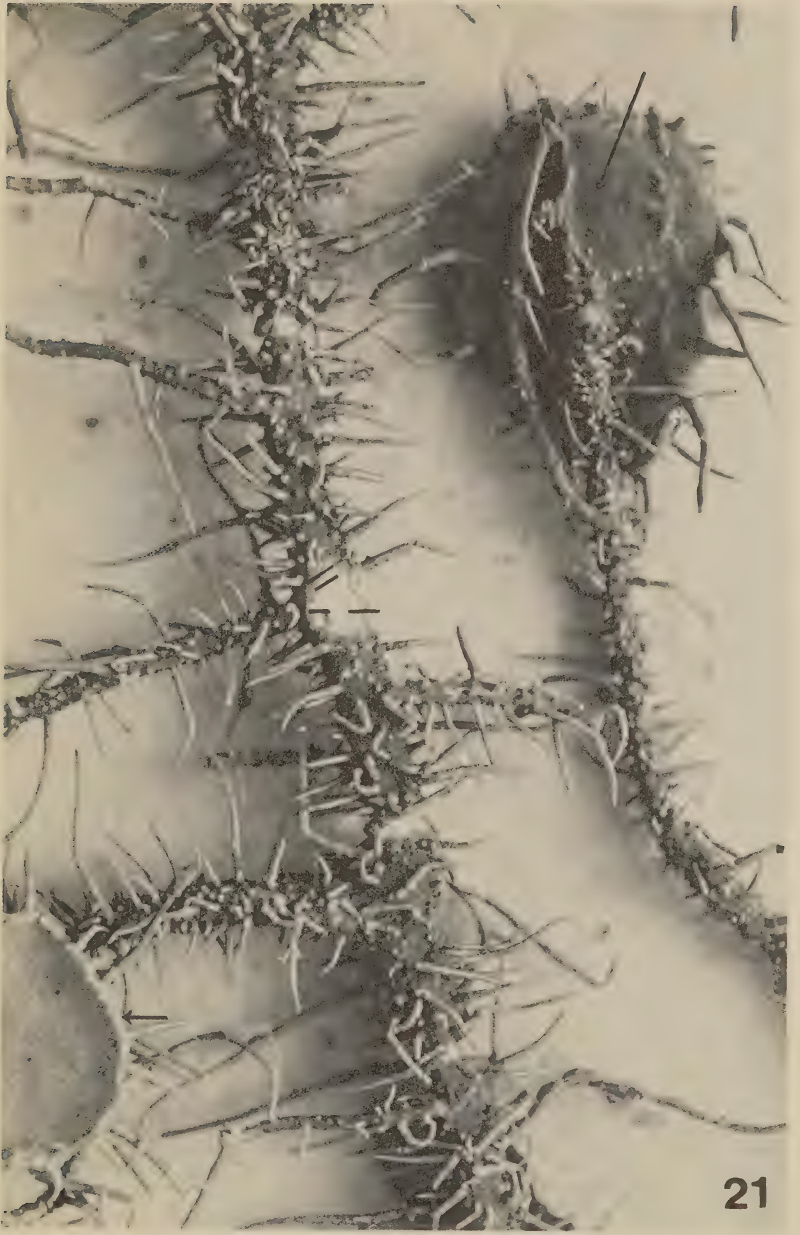


18



19


20



21

numbers of short, fertile thalli from eastern North America were seen, no specimens were found other than those of the type collection, which were undoubtedly collected by Michaux during his trip along the St. Lawrence and Sagueney Rivers (see Sargent, 1889). Possibly the taxon occurred on hardwoods in the St. Lawrence Valley and has been eliminated by logging and agriculture, as well as pollution. It should be searched for, nevertheless, on fallen tree branches in protected areas. Immature thalli should be recognizable as this taxon.

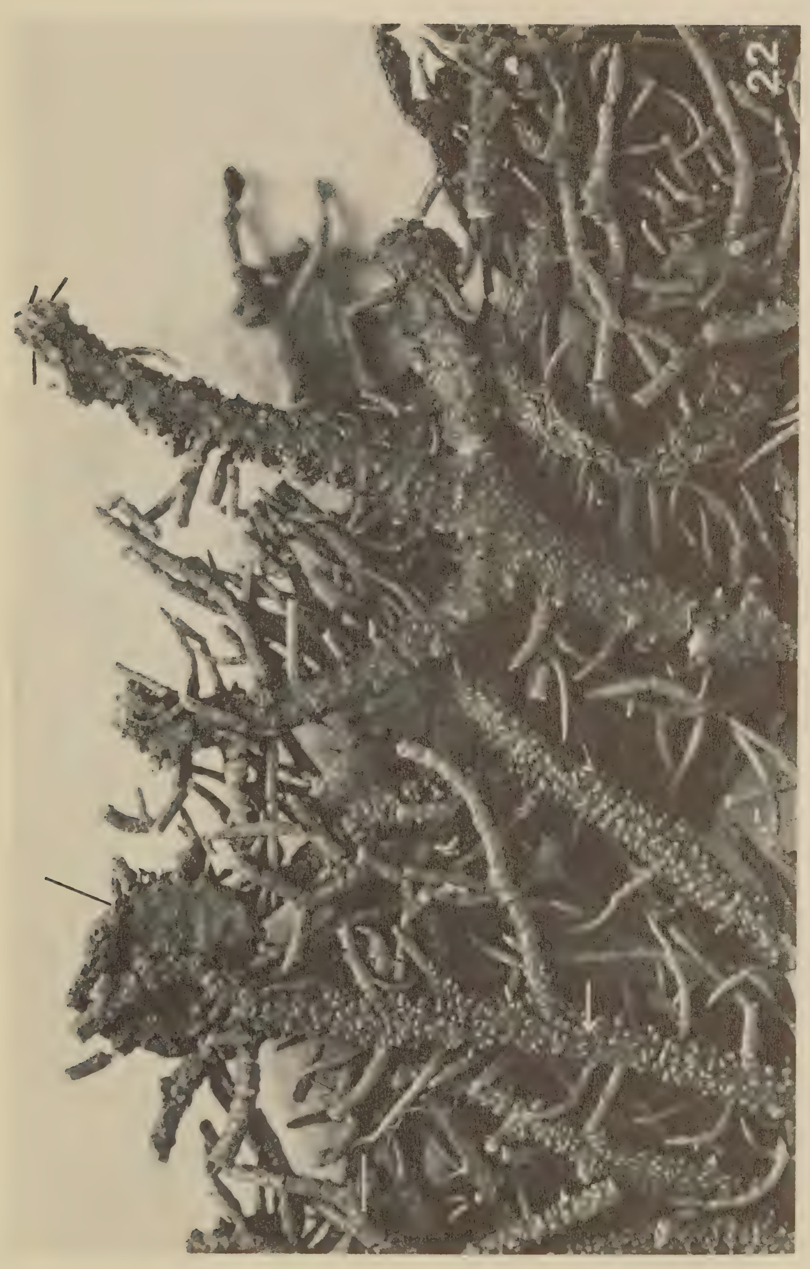
Usnea michauxii nom. nov. (Figs. 7, 8, 17, 24, 25)
U. florida (L.) Wigg. var. intermedia Michaux,
Flora Bor.-Am. 2: 332. 1803.

Lectotype: PC (Herb. Richard, Herb. Hue)(left thallus, second from base of sheet). Type locality: "Carolina."

Lichen acid detected: usnic acid.
Characteristics of taxon are as follows. Color: (fresh) a clear bluish gray green, near vetiver green (Ridgway, 1912), turning a light color between ecru olive and dark olive buff; in the lectotype, a light tawny olive; apothecial disks greenish yellow-gray (mostly naphthalene yellow or pale turtle green, becoming cream buff to chamois [Ridgway, 1912]), argus brown in type, with grayish white pruina (appearing light violet gray). There are scattered dark red spots (black in the type) on the thalli (pure red with faint purplish, not orangish tinge). Form of thallus (based on lectotype): divergently branched just above base of thallus; ramuli long, slender, widely spaced, separated by thin, low "papillae" covering the smooth, subnitid, somewhat foveolate branches (in this taxon the "papillae" rarely undergo further development into ramuli); in age, stipe and parts of large branches are covered with sharply raised, narrow, white-tipped tubercles that develop from elongating "papillae;" ramuli, as well as marginal cilia of apothecia, mostly inflated just above base, subnitid; branches sometimes constricted at ends of segments; exciple nitid, reticulate (less so in collections other than the type collection) but smooth. Anatomy (based on

Fig. 21 (preceding page). Usnea strigosa subsp. major, portion of lectotype. Surface of exciple is rough (arrow, upper right). Margin of apothecium (arrow, lower left) is mostly corticated. Left ends of two upper black lines in center, at cut, show thickness of cortex; axis lies between inner ends of 2 lower center lines. X 10.

Fig. 22 (opposite page). Usnea strigosa subsp. rubiginea isolectotype. Upper part of young thallus; apothecial cilia inflated and exciple somewhat reticulate (black line, top left); white line at left indicates articulation of inflated ramulus; 2 pairs of black lines at upper right show the outer edges of the axis and cortex. Branches coarsely "papillate" (white arrow, lower left). X 10.



22

lectotype): cortex thin, smooth, cortical cells ca. 10-12 um wide, the lumina ca. 1-1.5 um wide; medulla white, cottony in appearance, thin outer layer dense, inner part very lax, with intertwined, coarse hyphae; axis whitish (cortex ca. 50-60 um thick, medulla ca. 175-250 um wide, axis ca. 100-125 um wide); "papillae" ca. 50 x 50 um, marginal cilia of apothecia ca. 175 um wide at base; spores ca.(7.5)8-8.75(-11) um x 5-6.5 um.

Range: although large numbers of short, fertile thalli from eastern North America were seen, only two collections with locality indicated besides the type collection were found: Florida, Levy Co., Cedar Key, adjacent to High School, on live oak, Jonathan P. Dey 279, 1972 (Dey Herbarium), Wakulla Co., Ochlockonee State Park, in open area with scattered trees, I. Tavares 3616, 15 April 1986 (UC). The thalli from Cedar Key have a greater development of ramuli, more cilia, fewer foveae, and strongly tuberculate branches; the Wakulla County specimens are similar to these, but have fewer ramuli; both collections lack the extreme reticulation of the type. The Cedar Key specimens are now pale yellowish gray and have numerous red spots. The type collection of U. michauxii may have been obtained by Michaux on one of his short trips from Charleston, South Carolina, where his garden was located (see Sargent, 1889), or possibly it may have been collected on the northeast Florida coast and was mislabelled. This taxon seems to occur in open wooded areas near the coastline, but protected from the harsh environment of the open coast by intervening forested areas. Although it may be very abundant where found, it seems to be restricted in distribution.

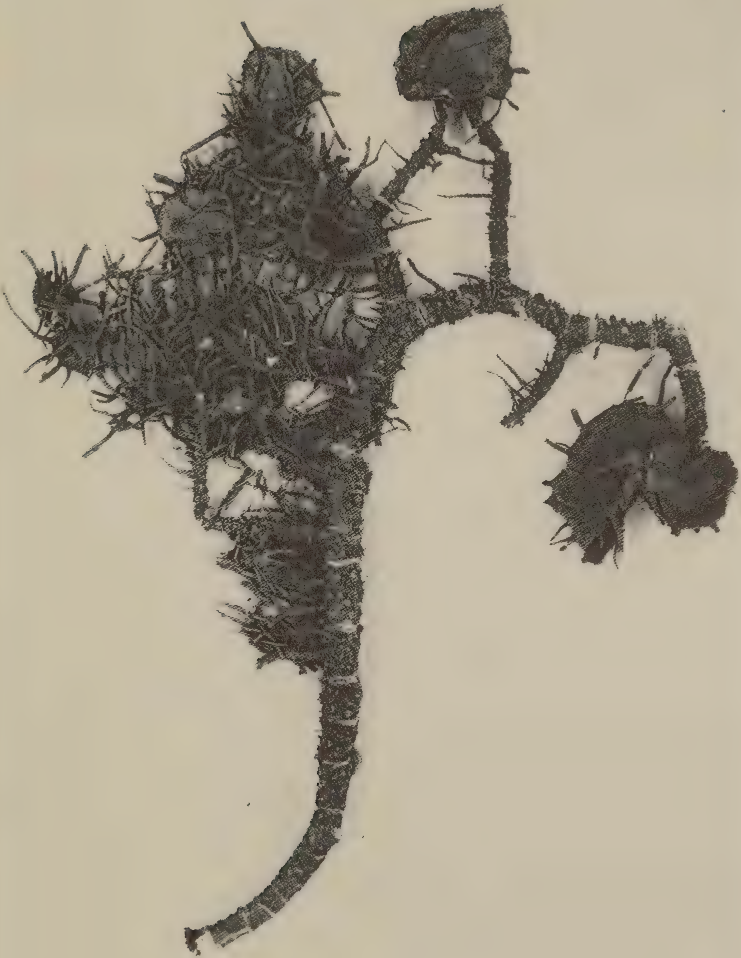
Despite its unusual appearance, the manner in which the ramuli are formed suggests a relationship between U. michauxii and U. strigosa. The medulla, however, is wider and more lax in appearance and it is uniformly white.

DISCUSSION AND CONCLUSIONS

There is much similarity between the subspecies of Usnea strigosa. However, there are significant anatomical differences as well as variation in branching patterns. Ahmadjian and Jacobs (1985) mentioned differences in the amount of fibril (ramulus) development between some mycobiont strains of synthetic thalli of Usnea strigosa. They could not indicate whether environmental or genetic factors were responsible. In Usnea strigosa subsp. rubiginea, U. tristis, and U. evansii,

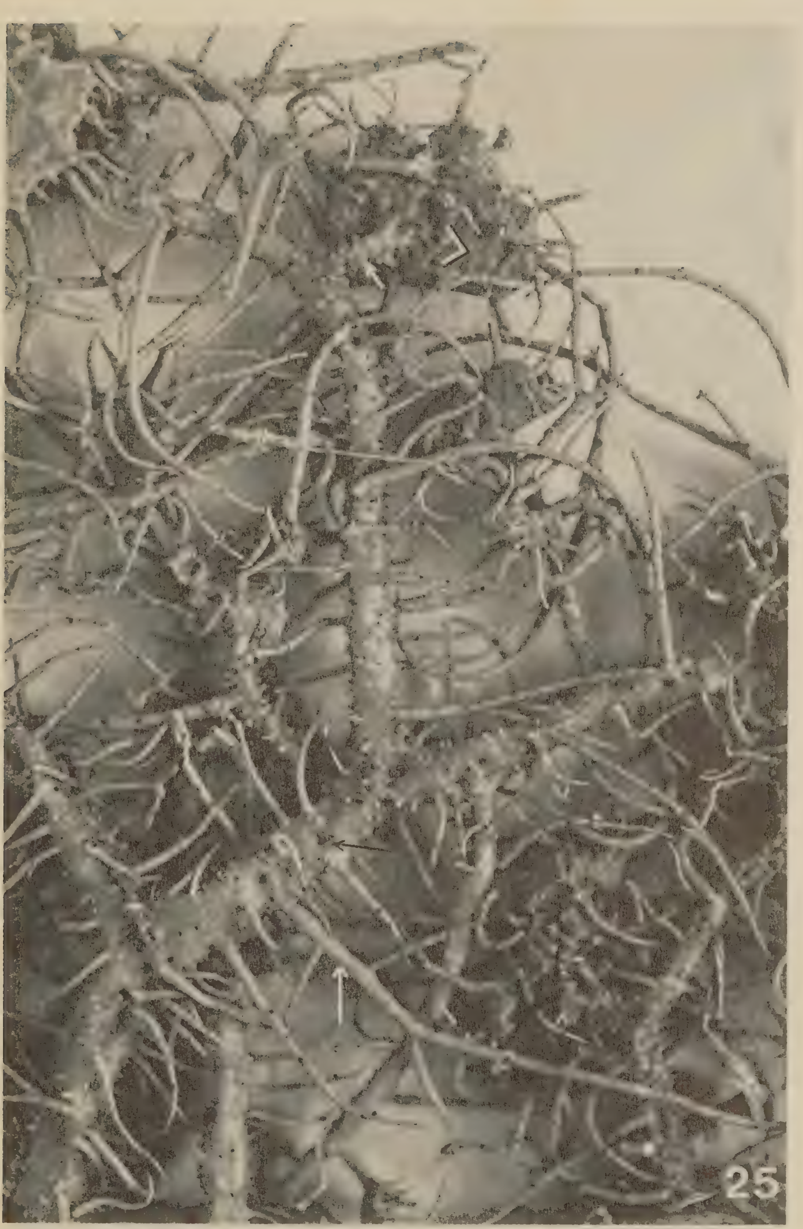
Fig. 23 (opposite page). Usnea strigosa subsp. rubiginea, lectotype. X 3.

Fig. 24 (following page). Usnea michauxii, lectotype. Broken white-and-black lines near top and bottom on main branch indicate width of axis and cortex in cuts. Small "papillae" visible; see inflated lateral branchlet at end of vertical black line in center; diagonal black line, lower left, ends at a typical black (discolored red) spot. X 15.



23

24



25

there seems to be suppression of ramulus formation in certain parts of the thallus, whereas ramuli normally grow abundantly in *U. strigosa* subsp. *major* and *U. endochrysea*. In *U. endochrysea*, as in *U. strigosa* subsp. *rubiginea*, there is an irregular production of long lateral branchlets (close together in the subspecies and widely spaced in *U. endochrysea*), whereas in *U. strigosa* subsp. *major*, there is normally a regular alternation of short and longer ramuli (the longer ramuli extend at fairly regular intervals into short lateral branchlets)(cf. figs. 21, 23, 26).

The cortical cell lumina of *U. strigosa* subsp. *strigosa* tend to be wider than those of the other taxa, including *U. endochrysea* (cf. figs. 12-14). As these figures indicate, *Usnea* cortex is composed of a branched network of cells (the branched characteristic of the surface was shown by Anglesea et al., 1983, although the early stages show a parallel surface arrangement as indicated also by Ahmadjian and Jacobs, 1985). The lumina of the cortical cells of *U. evansii* and *U. michauxii* are very narrow, whereas those of *U. endochrysea* are almost as wide as those of *U. strigosa* subsp. *strigosa*; like *U. endochrysea*, *U. tristis* has a cortex of more complex structure (Tavares, unpublished).

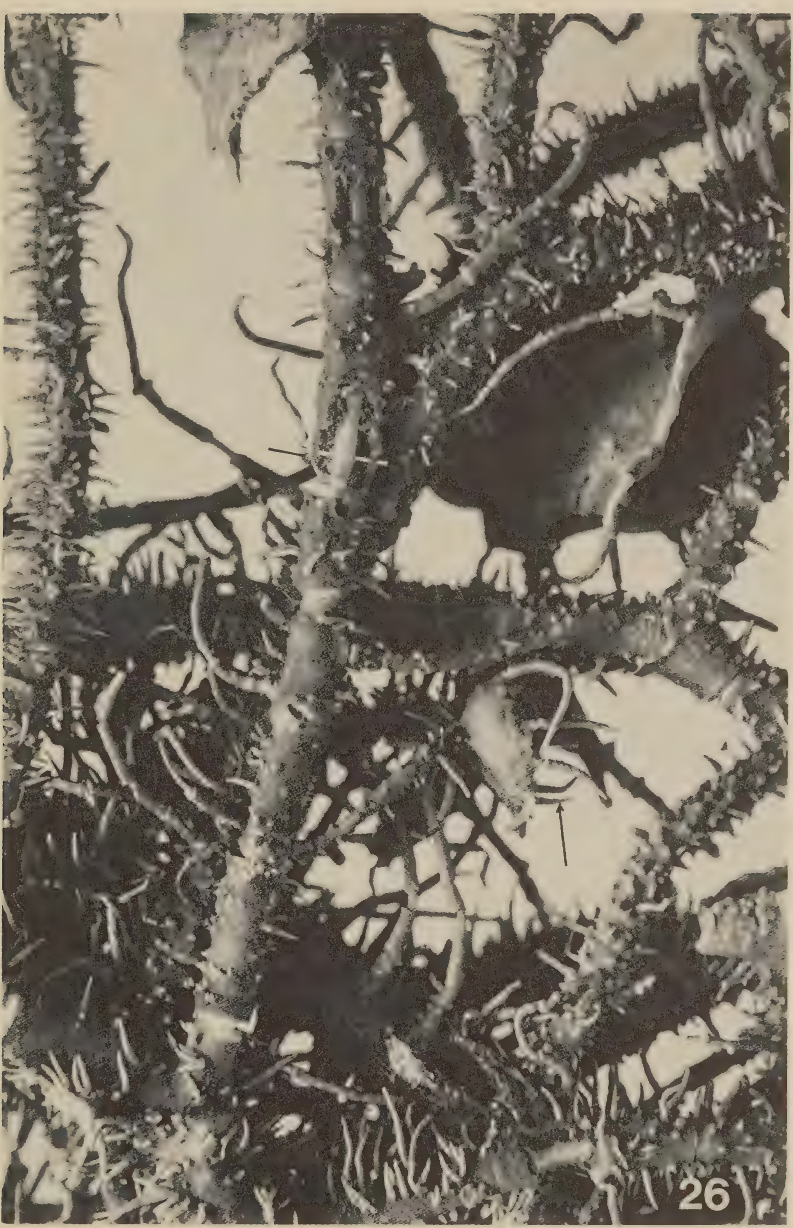
Like *U. endochrysea*, *U. evansii* and *U. tristis* have thin cortices, that of *U. tristis* forming depressions between ridges extending between tuberculate "papillae" (cf. figs. 26-28). In *U. evansii* the ramuli emerge from narrow outgrowths of the cortex, whereas those of *U. tristis* develop from moderate-sized "papillae." A key to species follows:

I. Thallus having black base, as in *Usnea florida*; cylindrical "papillae," gradually tapering ramuli, white medulla; usnic, salazinic acids present.
Usnea subfusca Stirton

I'. Thallus lacking black base (any darkening disappears with growth); "papillae" have predominantly sloping sides; ramuli tapering or inflated; medulla red or white; usnic acid present, often with norstictic, sometimes with psoromic or thamnolic acids.
  1. Small red spots scattered over branches and ramuli; cortex subnitid; "papillae" on stipes of apothecia elongate, sharply raised, rough-looking in age; ramuli elongate, slender, frequently inflated just above

Fig. 25 (preceding page). *Usnea michauxii*, lectotype. A subnitid reticulate exciple (v-line above), narrowly papillate stipe (white arrow above), fovea (black arrow, lower center), and inflated branchlet (white arrow below) are shown. X 10.

Fig. 26 (opposite page). *Usnea endochrysea*, with fragile ramuli and cilia (arrow, lower right) and lax, medium wide medulla and thin cortex (widths indicated by interrupted lines in center on main vertical branch). In crown of *Quercus nigra* L., Baird Drive, Baton Rouge, Louisiana, Shirley Tucker 6697, 4 December 1966 (Tucker herb.). X 10.



26

base; cortical cell lumina 1-1.5 um wide; cortex ca. 50-60 um thick; medulla ca. 175-250 um wide, white; axis ca. 100-125 um wide; thallus clear bluish gray green, turning yellowish. Usnea michauxii nom. nov.

1'. Red spots not present; medulla red or white.

2. Short, somewhat conical ramuli often crowded, sometimes interspersed with white-punctate areas of cortex resulting from clearly visible medullary spots preceding emergence of "papillae;" cilia of apothecia similarly short and conical to inflated; large branches often having pronounced ridges extending from bases of lateral branches; cortex ca. 50 um thick; medulla ca. 245 um wide, axis ca. 125 um wide; lumina of cortical cells extremely thin (not more than 1 um), often triangular in section (isotype); thallus bright yellowish gray green, turning olivaceous and brownish. Usnea evansii Mot.

2'. Cortical cell lumina typically wider (1-1.5 um or more), mostly sinuous or rounded in outline; "papillae" usually distinctly elevated before white shows through the cortex.

3. "Papillae" small to large and deformed; thin cortex tends to sink between "papillae" into depressions having ridged margins (rugae); ramuli and cilia inflated, short, sparse, often deformed; cortical lumina (isotype) 1-2.5(-3.5) um, with well-developed zone of radiating lumina; cortex ca. 75-100 um thick, medulla ca. 300 um wide, axis ca. 375 um wide; thallus deep blue-gray green, remaining dark in age. Usnea tristis Mot.

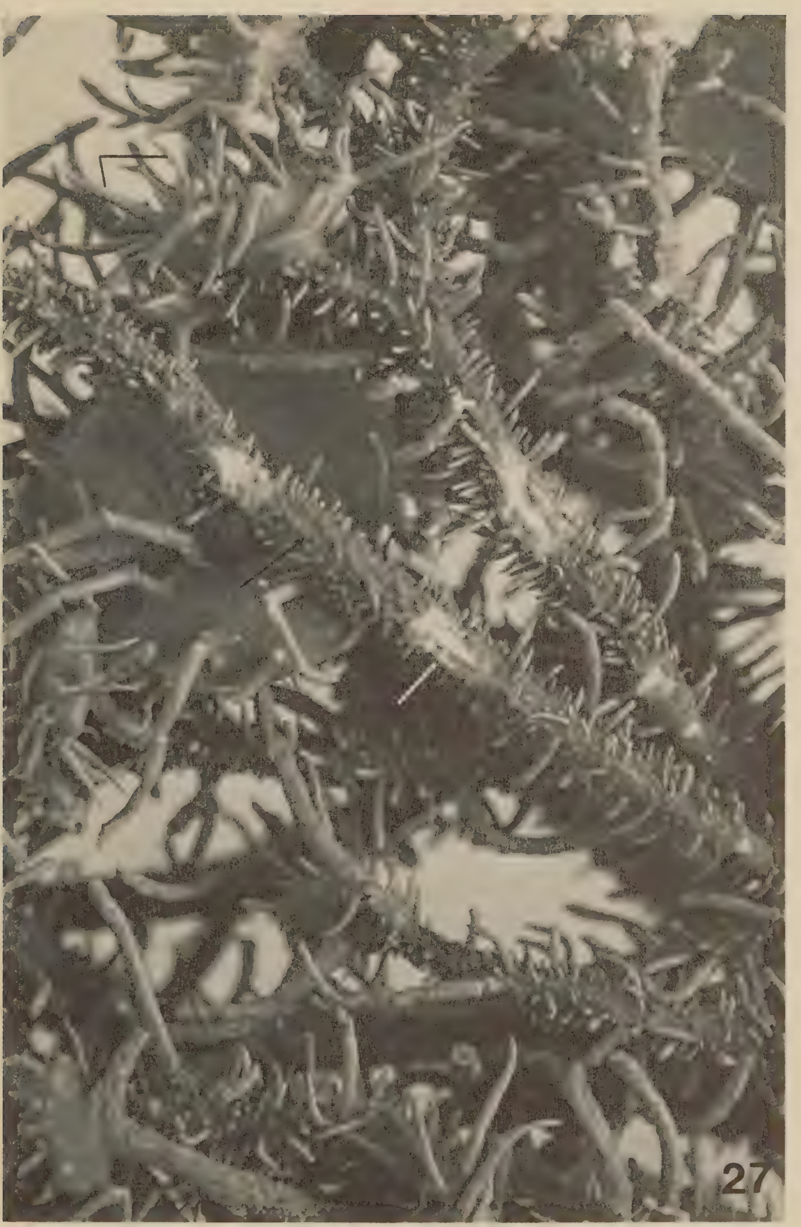
3'. Thalli generally remaining terete.

4. "Papillae" developing into delicate, fragile ramuli at irregular intervals on long branches emerging just above base of thallus; lateral branches short; apothecial cilia short, thin, often sparse; cortical cell lumina ca. 1.5-4 um; cortex ca. 50-100 um thick, medulla ca. 200-325 um wide; axis ca. 125-200 um wide (type); thallus blue-gray green, remaining gray green. Usnea endochrysea Stirt.

4'. Ramuli and cilia well developed, resistant to damage.

5. "Papillae" wide, often remaining undeveloped so that ramuli are few; lateral branchlets tend to be long and closely spaced in groups interspersed with unextended "papillae;" younger branchlets subnitid; cortical lumina ca. 1-2 (-3) um wide; cortex ca.200-225 um thick,

Fig. 27. Usnea evansii, with short, inflated cilia (v-line, upper left) and ramuli (left center line indicates punctate papillate outgrowths that become ramuli). Interrupted white line shows narrow cortex and medium narrow axis. On live oak on coastal dunes, Dauphin Island, Mobile Co., Alabama, Shirley Tucker 7216, 22 October 1967 (Tucker herb.). X 9.



27

medulla ca. 350 um wide, axis ca. 200-300 um wide; thallus dark olive in age.
Usnea strigosa subsp.
rubiginea (Michx.) comb. nov.

5'. "Papillae" medium in width, typically extending more or less regularly into ramuli; thallus cortex tends to be rough (rimose).

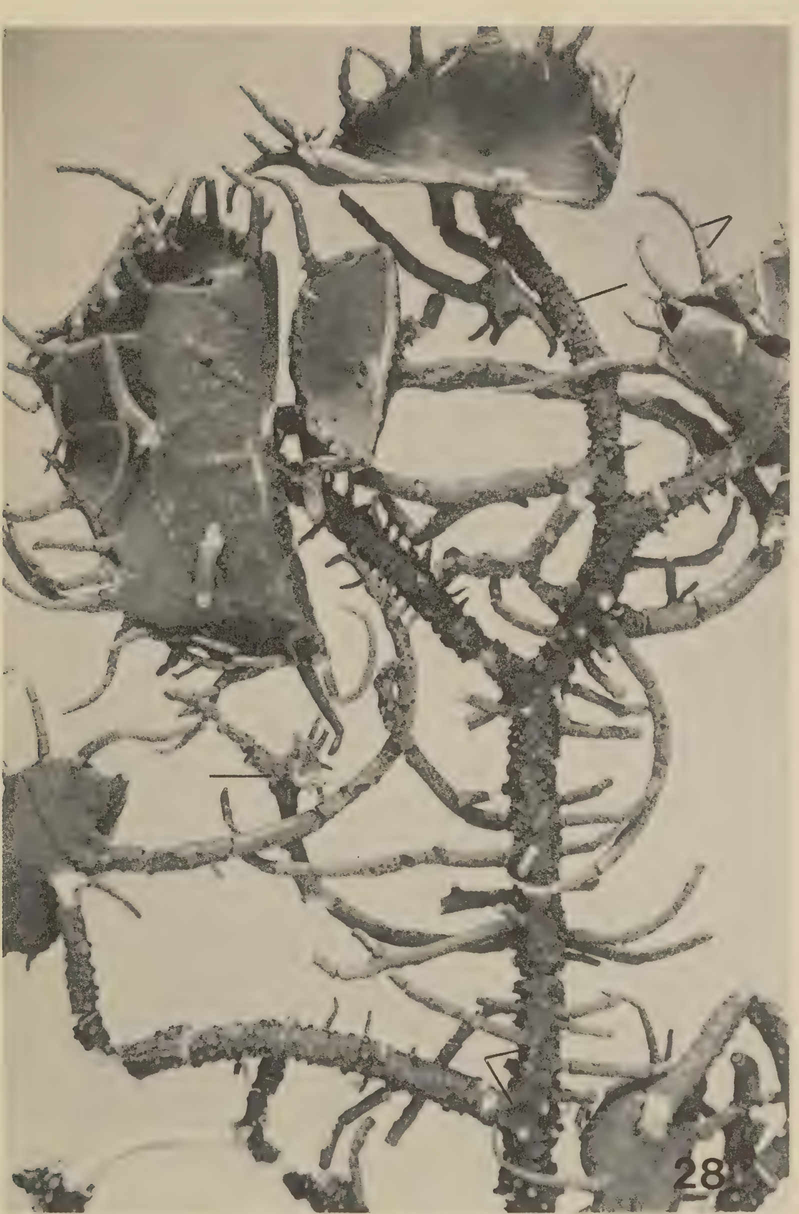
6. Ramuli typically regularly interspersed with short, lateral branchlets; cortical lumina small (ca. 1-2 um wide); cortex ca. 85-100 um thick, medulla ca. 200-325 um wide; axis ca. 175-400 um wide; thallus clear gray green turning yellowish.
Usnea strigosa subsp.
major (Michx.) comb. nov.

6'. Ramuli less regularly arranged, but not closely grouped; cortical lumina large (ca. 2-5 um wide)(lectotype); cortex ca. 75 um thick, medulla ca. 175 um wide, axis ca. 250 um wide (fig. 11); thallus persistently gray green.
Usnea strigosa (Ach.) A. Eaton
subsp. *strigosa*

The types of *U. strigosa* subsp. *strigosa*, subsp. *major*, and subsp. *rubiginea*, as well as of *U. endochrysea* and *U. tristis* and an isotype of *U. evansii* all have usnic and norstictic acids. Variation in form, therefore, takes place in this complex having similar chemistry in the different taxa. The lack of an acid (or perhaps the addition of another) may occur within a taxon without any pronounced difference in morphology (for example, only usnic acid was detected in the thalli shown in figs. 10-11). Nevertheless, preliminary observations suggest that color differences and length and arrangement of ramuli might sometimes be coordinated with the occurrence of certain lichen acids.

Of the groups of acid combinations mentioned by Fiscus (1972) in her survey of members of the *U. florida* group in North America, only usnic acid alone, norstictic and thamnolic as solitary acids associated with usnic, and the combinations usnic, norstictic, salazinic, and galbinic, usnic, norstictic and salazinic, and usnic, psoromic and conpsoromic are likely to be of interest with regard to the *U. strigosa* group. Fiscus did not indicate morphological characters associated with any of these chemical groups.

Fig. 28. *Usnea tristis*, portion of holotype. Stipe coarsely papillate (upper black line, right), cilia short, articulated (v-line, upper right, indicates breaks), rugose (ridges at ends of v-line at base)(line lower left center to young apothecium). On *Quercus rubra* L., Cold Run, Cass, West Virginia, F. N. Gray, 1928. X 7.



28

The ascospores in the U. strigosa group and in U. michauxii appear to be generally smaller than those of U. florida (Clerc, 1984). They lie more or less in the range that Clerc gives for U. rigida (Ach.) Röhl. s.l.

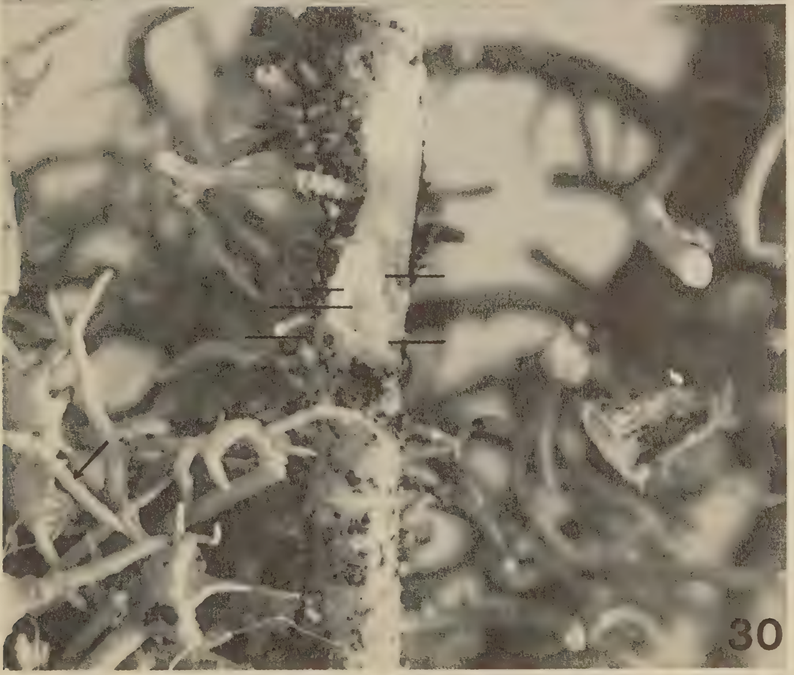
The taxa of Michaux can be distinguished primarily by their branching patterns, the relative widths (CMA) and characteristics of the cortex, medulla, and axis, and by the pattern of suppression or elongation of the incipient ramuli that form the papillate covering of the branches. They can be separated from the closely related taxa in eastern North America by the same means, and from U. florida by the absence of a conspicuous black base (see fig. 29) and by various combinations of other characters (fig. 30)(see Clerc, 1984; Motyka, 1936-1938).

ACKNOWLEDGMENTS

The author is especially indebted to Dr. Teuvo Ahti, University of Helsinki, as well as to the Director and staff of the Paris Museum of Natural History, Laboratory of Cryptogams, for locating and lending the Michaux specimens (the assistance of Peter Lowry, Missouri Botanical Garden, is also acknowledged). The loans of a fragment of the type of U. strigosa from the University of Helsinki and of a portion of the type of U. tristis kindly sent by Dr. Jan Bystrek, Lublin, have also proved invaluable for comparisons. Photographs for figs. 1-8, 12-14, 20, and 24 were taken by James Hendel, and those for figs. 10-11, 21-23, and 25-30 were taken by Julie Wolf (both of the Scientific Photographic Laboratory, University of California, Berkeley). The assistance of Charlotte Hannan with the drawings is also acknowledged. The author wishes to thank Dr. John Thomson, Dr. Mason Hale, and Mrs. Doris Baltzo for their criticism of the manuscript, as well as Dr. Rolf Santesson for his information. The kindness of the staffs and curators of herbaria and individuals lending specimens is much appreciated.

Figs. 29-30. Usnea florida. 29. Thallus having well developed black base (its upper end is at top of black line). On trees, Coed-y Brenen National Forest, Snowdonia National Park, Wales, Laurence G. Cool 431, May, 1979 (Cool herb.) 1 space lower right is 1 mm. 30. Portion of thallus, showing interior cut on main branch; center lines point to outer and inner edges of medulla, with lower left line indicating outer edge of branch; arrow at lower left indicates cilium of young apothecium. X 10.

29



30

LITERATURE CITED

Acharius, E. 1803. Methodus qua omnes detectos Lichenes. F. D. D. Ulrich, Stockholm. 393 p. (Supplement 52 p., Pls. I-VIII.)

__________. 1810. Lichenographia Universalis. J. F. Danckwerts, Göttingen. 696 p. Pls. 1-14.

Ahmadjian, V., and J. B. Jacobs. 1985. Artificial reestablishment of lichens. IV. Comparison between natural and synthetic thalli of *Usnea strigosa*. Lichenologist 17: 149-165.

Anglesea, D., G. N. Greenhalgh, and C. Veltkamp. 1983. The cortex of branch tips in *Usnea subfloridana*. Trans. Brit. Mycol. Soc. 81: 438-444.

Clerc, P. 1984. Contribution a la révision de la systématique des Usnées (Ascomycotina, *Usnea*) d'Europe. 1. *Usnea florida* (L.) Wigg. emend. Clerc. Cryptogamie, Bryol. Lichenol. 5: 333-360.

Culberson, Chicita F., and H. Kristinsson. 1970. A standardized method for the identification of lichen products. J. Chromatog. 46: 85-93.

Fiscus, Susan A. 1972. A survey of the chemistry of the *Usnea florida* group in North America. Bryologist 75: 299-304.

Hale, M. E., Jr. 1962. The chemical strains of *Usnea strigosa*. Bryologist 65: 291-294.

Herre, A. W. C. T. 1910. The lichen flora of the Santa Cruz Peninsula, California. Proc. Wash. Acad. Sci. 12 (2): 27-269.

Howard, R. A., and K. Bremer. 1982. Olof Swartz in Boston 1783. Rhodora 84: 143-148.

Howe, R. H., Jr. 1915. A monograph of the *Usneaceae* of the United States and Canada. Part II. Mem. Thoreau Mus. Nat. Hist. Middlesex School, Concord, Massachusetts 1 (2?): 1-34. Chart.

James, P. W. 1979. Notes on *Usnea rubiginea* and *U. rubicunda*. Lichenologist 11: 322-323.

Michaux, A. 1803. Flora boreali-americana. Vol. 2. Facsimile 1974. Hafner Press, New York, London (Classica Botanica Americana vol. 3). 340 p.

Moore, Barbara J. 1968. The macrolichen flora of Florida. Bryologist 71: 161-266.

Motyka, J. 1936-1938. Lichenum Generis *Usnea* Studium Monographicum. Pars Systematica. Vols. 1-2. Publ. by author. Lublin. 651 p.

Ridgway, R. 1912. Color Standards and Nomenclature. Publ. by author. Washington, D. C. 44 p. Pls. I-LIII.

Sargent, C. S. 1889. Portions of the journal of André Michaux, botanist, written during his travels in the United States and Canada, 1785 to 1796. With an introduction and explanatory notes. Proc. Amer. Philos. Soc. 26: 1-145.

Tavares, Isabelle I., and Doris E. Baltzo. 1977. Cortical anatomy of *Usnea* (Lichenes) and its use in taxonomy. Second Int. Mycol. Congr. [Tampa, 1977], Abstracts vol. M-Z: 657.

Thomson, J. W. 1967. The lichen genus *Cladonia* in North America. University of Toronto Press, Toronto. 172 p. Figs. 1-60. Pls. 1-26.

Tuckerman, E. 1847. A synopsis of the Lichenes of the northern United States and British America. Proc. Amer. Acad. Arts Sci. 1: 195-285.

MYCOTAXON

Vol. XXX, pp. 69-80 October-December 1987

NEW OR INTERESTING GREENLAND LICHENS IV

ERIC STEEN HANSEN

Botanical Museum
University of Copenhagen
Gothersgade 130, DK-1123 Copenhagen K, Denmark

&

JOSEF POELT

Institut für Botanik der
Karl-Franzens-Universität Graz
Holteigasse 6, A-8010 Graz, Österreich

SUMMARY

The accessible material of fifteen taxa of Greenland lichens have been studied. Nine taxa, viz. *Acarospora stapfiana*, *Glypholecia scabra*, *Lecania cyrtella*, *Lecidea ileiformis*, *Melanolecia transitoria*, *Pertusaria atra*, *Phaeorrhiza sareptana* var. *sphaerocarpa*, *Steinia geophana* and *Thrombium epigaeum* are additions to the known lichen flora of Greenland. *Fulgensia bracteata* ssp. *deformis* is new to N. Greenland. The distribution in Greenland of this taxon has been mapped.

INTRODUCTION

In the summer of 1982 and 1983 the senior author and Mr. H. Ullrich carried on investigations of the lichen vegetation of the area around Godhavn (S.Disko) and Mârmorilik in C.W.Greenland. A great number of new or rare lichens were collected and form the basis of important new reports on different groups of lichens. This paper deals with a part of the most interesting collections. They were kindly sent on loan to E.S. Hansen, who combined the study of them with investigations of available Greenland material deposited in herb. C and O.

LIST OF SPECIES

ACAROSPORA STAPFIANA (Müll.Arg.) Hue (Syn. *Placodium stapfianum* Müll.Arg.) - C.W.Greenland: S. Disko, Godhavn, site near the Arctic Station, 69°15'N 53°34'W, growing parasitically on *Caloplaca trachyphylla* (Tuck.) Zahlbr. on S.-exposed, vertical, basaltic rock; two specimens, leg. J. Poelt & H. Ullrich (GZU, C).

Thallus forms greenish yellow, rounded, up to 2 mm broad areoles. The apothecia are single in the areoles (more in further divided areoles), at first punctiform, but later with a distinct, dark brown disc. The spores are broadly ovoid-spherical, 3.5 x 3-4 µm.

A. stapfiana is an addition to the known lichen flora of Greenland. It has previously been reported from Iran and Afghanistan (Poelt & Steiner 1971).

ARTHRORHAPHIS VACILLANS Th.Fr. & Almq. ex Th. Fr. (Syn. *A. anziana* (Lynge) Poelt; *Bacidia anziana* Lynge) - C.W.Greenland: S. Disko, Sinigfik, 69°21'N 52°55'W, on mineral soil over rock near the sea; one specimen, leg. J. Poelt & H. Ullrich (GZU). - W.Disko, Nordfjord, Kugssinerssuaq, 69°55'N 54°25'W, on mineral soil; one specimen, leg. P. Gelting (C).

E.S. Hansen checked the whole Greenland material (altogether c. 150 specimens) of *Arthrorhaphis* kept at C in addition to all collections of *"Bacidia anziana"* at O and concluded that only three specimens (kept at O) have 4 to 6-celled spores < 20µm, viz. the collections from Kapp Petersens, Veganeset and Husbukta situated between 72°N and 73°N in E.Greenland (Lynge 1940). The record of *A. anziana* from Perdlertut on Disko Island in W.Greenland (Alstrup 1979) could not be checked, as there are no apothecia left in this material, but Alstrup recorded the spore measurements to 19-22 x 3.5 µm, indicating the identity of *A. vacillans*.

Fertile collections of *A. citrinella* (Ach.) Poelt from Greenland are numerous, and it apparently is more or less frequent in all parts of Greenland on bare soil (rarely on a thin layer of soil over rocks). Sterile material of *Arthrorhaphis* from Greenland is extremely difficult or even impossible to determine. Both species develop convex areoles that finally breaks up into small squamules leaving a central cavity. The areoles are often confluent and ± sorediate indicating the identity of var. *citrinella*, although traces of *Baeomyces*, on which it grows parasitically in the first stage of development, cannot be found.

A. vacillans is known from the arctic regions and the Alps (Poelt & Vězda 1977).

FULGENSIA BRACTEATA (Hoffm.) Räs. ssp. DEFORMIS (Erichs.) Poelt (Syn. *Caloplaca bracteata* (Hoffm.) Jatta - C.W.Greenland: Søndre Strømfjord, 67°01'N 50°43'W, on loess on steppe-like slope above the airport; six specimens, leg. V. Alstrup, J. Poelt & E.Steen Hansen, respectively (GZU, C). - N.E. Disko, Qutdligssat, Kitdlerpait, 70°06'N 53°02'W, 80 m, on dry, gravelly soil on raised marine terraces with Dryas vegetation; one specimen, leg. P. Gelting (C). - Nûgssuaq Peninsula, Âta, 70°18'N 53°00'W, 10 m, on ± calcareous soil in Dryas-heath together with Catapyrenium lachneum; one specimen, leg. P. Gelting (C). - Nûgssuaq Peninsula, Nussaq, 70°25'W 54°05'W, 15 m, among mosses on soil in heath dominated by Carex rupestris; one specimen, leg. P. Gelting (C). - Mârmorilik, 71°07'N 51°17'W, on soil (over limestone and siliceous rock rich in iron near Sydsø); two specimens, leg. J. Poelt & H. Ullrich (GZU). - Kangerdluarssuk, 71°23'N 51°40'W, over mosses; one specimen, leg. N. Ulrik Hansen (C). - C.E. Greenland: Mesters Vig, 72°08'N 23°50'W, on mosses and soil; one specimen, leg. R.W.M. Corner (C). - Skeldal, 72°15'N 24° 00'W, on soil; one specimen, leg. D.R. Spearing, N.P. Lasca, M.F. Baad & K.Schmidt (C). - N.E. Greenland: Strindberg Peninsula, Solstrand, 73°35'N 24°37'W, over mosses and soil; two specimens, leg. P. Gelting (C, O). - Strindberg Peninsula, Eskimonæs, 74°06'N 21°20'W, on dry, stony soil; three specimens, leg. P. Gelting & Th. Sørensen, respectively (C, O). - N.Greenland: Kap København, 82°24'N 21°11'W, on soil in polygone-tundra; two specimens, leg. G.S. Mogensen (C). - Astrup Fjord, 81°57'N 30°40'W, 100 m, on soil in SE.-exposed fell-field; one specimen, leg. P. Johnsen (C).

All of the specimens listed above represent new Greenland records of F. bracteata spp. deformis. There is also a correctly identified specimen from Thule District (no. 7176a, W.S. Benninghoff & H.C. Robbins) in herb. C. but we have not been able to trace the exact locality on the basis of the informations given on the lable. E.S. Hansen did not find F. bracteata on his expedition to Thule in the summer of 1986. Previous records of F. bracteata in Greenland can be found in the following papers: Vainio (1905), Galløe (1910), Lynge (1923, 1937, 1940), Böcher (1954), Gelting (1955), E.S. Hansen (1982). All relevant specimens (herb. C, O) have been mapped on Plate 1. The two collections made by Th. Wulff at Low Point and Cape Benet, respectively, during the second Thule expedition to the north coast of Greenland 1916-18 and kept at C (Lynge 1923) appear to belong to Lecanora geophila (Th.Fr.) Poelt (syn. L. pachythallina Lynge).

The thallus of F. bracteata ssp. deformis is composed of small verrucose to squamulose portions forming sulphurous to orange yellow groups of areoles more or less densely covered by small schizidia (Poelt 1969). Apothecia are not rare in the Greenland material. The disc is up to 1.5 mm broad, orange red, reacting K+purple. The thalline margin is slightly paler than the disc and usually distinctively developed. The spores are simple, hyaline (12-15 x 5-5.5 µm).

F. bracteata ssp. deformis is previously known from central Germany, the Alps, the Carpathians and Lapland (Poelt & Vězda 1977). It is new to North Greenland. Most of the collections are, however, from more or less summerdry areas in central E. and W. Greenland. So far *F. bracteata* has not been collected in more southern parts of Greenland. *F. bracteata* ssp. *bracteata* is not known from Greenland.

GLYPHOLECIA SCABRA (Pers.) Müll.Arg. (Syn. *Acarospora s.* (Pers.) Th.Fr.) - C.W.Greenland: Mârmorilik, Sydsø, 71°08'N 51°17'W, on siliceous rock (with some content of Ca); two specimens, leg. J. Poelt & H. Ullrich (GZU, C).

Thallus of the present specimens is bluish-pruinose, foliose, umbilicate and up to 1.5 cm broad, reacting C+ rose, K-, P-. The apothecia are numerous, compounded and immersed in thallus. The disc is brownish. The spores are numerous in ascus, hyaline, spherical, 3.5 x 4 µm.

G. scabra is new to Greenland. It is previously known from, e.g., Norway, the Alps, Tatra, the Himalayas and North America (Poelt 1969, Thomson 1979).

LECANIA CYRTELLA (Ach.) Th.Fr. - C.W.Greenland: S. Disko, Lyngmarksfjeldet near Godhavn, 69°16'N 53°35'W, on bark of *Salix*; one specimen, leg. J. Poelt & H. Ullrich (GZU).

Thallus of the present plant is thin, pale grey to white and partly covered by numerous, up to 0.4 mm broad apothecia with a reddish brown, flat to convex disc and a thin, ± crenulate thalline margin. The spores are 2-celled, hyaline, 10-16 x 4-5 µm.

L. cyrtella is a corticolous species. *L. cyrtella* is new to the area, and it was not mentioned in Alstrup's list of epiphytic lichens from Greenland (Alstrup 1982). The species is widely distributed on deciduous trees (*Salix*, *Populus*, *Sambucus* etc.) in the northern hemisphere (Ozenda & Clauzade 1970). It extends its distribution into the arctic regions in places, where tree growths can be developed.

LECANORA CHLOROLEPROSA (Vain.) Magn. - S.W.Greenland: Naimiat at the north coast of Bredefjord, 60°59'N 46°12'W, 30 m, on basaltic rock; one specimen, leg. V. Alstrup (C). - C.W.Greenland: S. Disko, Godhavn, 69°15'N 53°33'W, on gneissic and basaltic rocks; two specimens in addition to those previously mentioned by E.S. Hansen (1983), leg. J. Poelt & H. Ullrich (GZU). - S.E.Greenland: Angmagssalik, 65°36'N 37°38'W, on norite together with, e.g., *Pseudephebe minuscula*, *Placynthium aspratile* and *Phylliscum demangeonii*; five specimens, leg. E. Steen Hansen (C).

The maximum size of the thallus verrucules in the present material is 3 mm, but most of them are <0.3 mm. Mature apothecia, the first found in Greenland collections of *L. chloroleprosa*, occur on a specimen from Angmagssalik. They are up to 0.8 mm broad with a pale brown disc.

The distribution of *L. chloroleprosa* has previously been outlined by E.S. Hansen (1983).

LECIDEA ILEIFORMIS Fr. - C.W.Greenland: Mârmorilik, Sydsø, 71°07'N 51°17'W, on soil over limestone and siliceous rock rich in iron; one specimen, leg. J. Poelt & H. Ullrich (GZU).

The thallus of the studied specimen forms a thick, rugged, greyish white to chalk-white crust, loosely attached to the soil. The protuberances are similar to those occasionally found on the thallus of *Ochrolechia frigida*. The apothecia are adnate, convex, black, up to 0.8 mm broad, sometimes aggregated. The black thalline margin is disappearing. The hypothecium is pale claret-coloured to salmon-pink (in KOH). The upper part of the hymenium is greyish green. The spores are 1-celled or rarely 2-celled, hyaline, ellipsoid, 9-13 x 3-5 µm.

L. ileiformis is an addition to the lichen flora of Greenland. Its world distribution is incompletely known. Fries (1870-74) reports on the species from Dovre in Norway.

LEMPHOLEMMA MYRIOCOCCUM (Ach.) Th.Fr. (Syn. *Physma polyanthes* (Schrad.) Arn.) - S.W.Greenland: Narssarssuaq, 61°10'N 45°26'W, over mosses in scrub; two specimens, leg. P. Gelting (C). - C.W.Greenland: S. Disko, Godhavn, 69°15'N 53°33'W, over mosses in several sites, e.g. basaltic rocks temporarily moistened by seeping water together with, e.g., *Toninia caeruleonigricans*, *Catapyrenium lachneum* and species of *Caloplaca*; seven specimens, they are, except one (leg. J. Poelt & H. Ullrich; GZU) collected by P. Gelting (C). - S. Disko, Blåfjeld, Nuk kitleq, 69°22'N 54°15'W, 25-30 m, over mosses on seasonally moist, S-exposed face of a basaltic rock; two specimens, leg. P. Gelting (C). - Diskofjord, Kangikitleq, 69°27'N 53°30'W, 6 m, over mosses in bog; one specimen, leg. P. Gelting. - Diskofjord, Kuânerssuit, Kvangrotten (Orpit qaqa), 69°35'N 53°25'W, over mosses on temporarily moistened breccia; two specimens, leg. P. Gelting (C). - E. Disko, Qutdligssat, 70°05'N 53°01'W, on mosses; one specimen, leg. P. Gelting (C).

Alstrup (1981) previously recorded *L. myriococcum* from Sârdloq (64°22'N 51°39'W), which is the second S.W. Greenland locality for the species. In his paper on the macrolichen flora of S.W.Greenland Dahl (1950) listed four localities, all situated in the Julianehåb District, for *Lempholemma* sp. We have not seen this material that possibly can include either *L. myriococcum* or *L. radiatum* (cf. E.S. Hansen 1984).

The thallus of the Greenland plants of *L. myriococcum* is of varying size, up to 2 cm broad, irregular lobate, greenish black and usually covered by numerous warts. The phycobiont is *Nostoc*. The apothecia are first poriform, later urceolate, up to 0.4 mm broad with a greenish brown disc. The spores are simple, hyaline, ± globose c. 9-14 µm. *L. myriococcum* is widely distributed in Europe, North Africa and Australia.

MELANOLECIA TRANSITORIA (Arn.) Hertel. - C.W.Greenland: Umanak, Mârmorilik, 71°08'N 51°17'W, 480-500 m, on calcareous sandstone; one specimen, leg. J. Poelt & H. Ullrich (GZU).

This specimen consists of scattered, small, <0.6 mm broad, black apothecia with a somewhat swollen thalline margin. In Poelt & Vězda (1981) H. Hertel described the structure of the apothecia of *Melanolecia*. He also called attention to the fact that the members of *Melanolecia* may be mistaken for species of *Huilia*, *Lecidea* or *Tremolecia*.

M. transitoria is an addition to the lichen flora of Greenland. It is earlier reported from the Alps and Spitzbergen (Poelt & Vězda 1981).

PERTUSARIA ATRA Lynge. - C.W.Greenland: S. Disko, Skarvefjeld NE of Godhavn, 69°17'N 53°33'W, c. 500 m, on dead mosses, infested by *Rhizocarpon bryonthae* Poelt; one specimen, leg. J. Poelt & H. Ullrich (GZU).

Thallus of the present specimen forms a greyish white, slightly tuberculate crust that covers the moss substrate. The fertile verrucae are up to 0.8 mm broad with a black, sunken disc. The epithecium reacts K+ distinctly violet. Although both 1- and 2-spored asci occur, we venture to refer the plant to *P. atra*. It differs from *P. bryontha*, e.g., by the black colour of the disc of the apothecia and the number of spores per ascus (two by *P. atra*, one by *P. bryontha*). E.S. Hansen has studied the Greenland material of *P. bryontha* kept at C without finding any additional specimens of *P. atra*. However, we cannot conclude that the above specimen is the only so far known record from Greenland, as the Greenland material of *Pertusaria* is still under revision.

Dibben (1980) considers *P. atra* to be an eastern arctic endemic species previously known only from the arctic tundra of eastern Canada. The new Greenland specimen suggests a possible wider distribution of the species.

PHAEORRHIZA SAREPTANA (Tomin) Mayrhofer & Poelt var. SPHAEROCARPA (Th.Fr.) Mayrhofer & Poelt (Syn. *Rinodina nimbosa* (E.Fr.) Th.Fr. var. *sphaerocarpa* Th.Fr.) - C.W.Greenland: Søndre Strømfjord, Angujartorfiup nunâ, Arnangarngup kûa, c. 66°30'N c. 51°15'W, 150-170 m, on mineral soil over S-exposed rock composed of fenite; one specimen, leg. V. Alstrup (C). - Søndre Strømfjord, 67°01'N 50°43'W, on loess on steppe-like slope above the airport together with, e.g. *Physconia muscigena*, *Caloplaca tominii* and *Phaeorrhiza nimbosa*; four specimens, leg. J. Poelt & E. Steen Hansen, respectively (GZU, C). - Søndre Strømfjord, site near Store Saltsø, 66°59'N 50°37'W, ca. 100 m, on loess; one specimen, leg. J. Poelt & H. Ullrich (GZU). - Nûgssuaq Peninsula, Manik, 70°12'N 52°36'W, 20 m, on mineral soil together with *Caloplaca tominii*; two specimens, leg. P. Gelting (C). - N.E.Greenland: Kjerulf Fjord, c. 73°15'N 27°10'W, on mineral soil; one specimen, leg. B. Lynge (C).

Most of the specimens are well developed consisting of small, lobate, yellowish brown, greyish brown or almost pure grey, pruinose squamules with up to 1 mm broad, hemispherical, pruinose, bluish grey to black apothecia. The spores are 2-celled, brown with slightly thickened apical walls, 17-20 x 8.5-10 µm.

P. sareptana has previously been reported from Norway and the Alps, where it is characterized by a very rare occurrence (Poelt & Vězda 1981). It is an addition to the lichen flora of Greenland.

RIMULARIA INSULARIS (Nyl.) Rambolt & Hertel - C.W.Greenland: S. Disko, Kangerdluarssuk, 69°29'N 53°55'W, 0-30 m, growing along the margin of thalli of *Lecanora bicincta* on a basaltic rock; one specimen, leg. J. Poelt & H. Ullrich (GZU).

The thallus of the studied plant is verruculose with flat to convex, brown and somewhat shining areoles. Apothecia are abundant. They are shining black, adnate, to 0.6 mm broad and often conglutinate.

R. insularis is a rarely collected species in Greenland, previously reported from only three localities on the central part of the west coast (E.S. Hansen 1986). Here it grows in connection with lichens belonging to the *Lecanora rupicola* group. The chemotypes of *L. rupicola* are at present analyzed by C. Leuckert and the senior author of this paper.

SCHADONIA FECUNDA (Th.Fr.) Vězda et Poelt (Syn. *Lopadium fecundum* Th.Fr., *L. sociale* Hepp ex Körb.) - C.W.Greenland: W. Disko, Mellemfjord, Sioranguaq, 69°43'N 54°28'W, 50 m, over mosses on basaltic ledge near waterfall; one specimen, leg. P. Gelting (C). - Mârmorilik, 71°08'N 51°17'W, 850-970 m, over mosses on calcareous hill; one specimen, leg. J. Poelt & H. Ullrich (GZU).

The thallus of *S. fecunda* forms a thin brownish grey crust over mosses and plant fragments. The apothecia are black, up to 1 mm broad. The asci contain up to eight, richly muriform, hyaline spores measuring 22-40 x 10-18 µm.

S. fecunda is a rare species in Greenland, being previously reported form a single locality, viz. Blåfjeld on S. Disko (Lynge 1937). Like *Schadonia alpina* Körb. that is known from Qivâqe in Sukkertoppen district (Alstrup 1981), *S. fecunda* is presumably somewhat neglected in Greenland. It has also been reported from the Alps, Scandinavia, Tatra, Siberia, Colorado and Alaska (Thomson 1979; Poelt & Vězda 1981).

STEINIA GEOPHANA (Nyl.) Stein (Syn. *Lecidea g.* Nyl.) - C.W.Greenland: S. Disko, Godhavn, site just north of the Arctic Station, 69°15'N 53°34'W, 20-50 m, on dead *Peltigera* over basaltic rock; one specimen, leg. J. Poelt & H. Ullrich (GZU).

Thallus of this specimen is very thin, covering the substrate as a yellowish grey film. The apothecia are dark brown, high convex to hemispherical and up to 0.3 mm broad. An exciple is lacking. The asci contain up to sixteen (often twelf or fewer) hyaline, globose spores (5-7 µm).

The substrate tolerance of S. geophana is relatively broad. The lichen has been reported from ± calciferous, sandy or clayey soil, loess, rotten wood and dead plant fragments (Poelt & Vězda 1977; Santesson 1984).

S. geophana is distributed in Europe and North America (Ozenda & Clauzade 1970). It is new to Greenland.

THROMBIUM EPIGAEUM (Pers.) Wallr. (Syn. Verrucaria epigaea Ach.) - C.W.Greenland: S. Disko, Godhavn, site north of the Arctic Station, 69°15'N 53°34'W, on creeping soil over gneissic rock; three specimens, leg. J. Poelt & H. Ullrich (GZU).

The thallus of the studied material is thin and yellowish grey. The perithecia (<0.2 mm) are brownish black, broadly spherical and partly immersed in the thallus with only the tip exposed. The paraphyses are filamentous and colourless. The spores have been reported as 1-celled, hyaline, 16-25 x 6-8 µm (Wirth 1980), but are often poorly developed in this material.

"Verrucaria epigaea" has previously been reported from "Sarfanguak" in W.Greenland (Branth & Grønlund 1888). This old collection, however, is correctly identified as Lecanora geophila (Th.Fr.) Poelt (Syn. L. pachythallina Lynge) (E.S.Hansen 1984). Thus the new specimens of T. epigaeum collected by Poelt and Ullrich are the first from Greenland.

The species is widely distributed in Europe and North America (Zahlbruckner 1922).

ACKNOWLEDGEMENTS

The authors wish to thank the curators of herb. O for loan of relevant material. Our thanks are also due to Mette Krogshede for preparing the drawings, Ole Lansø for typing the manuscript and Ingvar Kärnefelt (Lund) for reading the manuscript.

LITERATURE CITED

Alstrup, V. 1979. Notes on selected Greenlandic Lichens. Bot. Tidsskr. 74:155-163.

Alstrup, V.1981. Notes on some lichens and lichenicolous fungi from Greenland. Nord. J. Bot. 1:120-124.

Alstrup, V.1982. The Epiphytic Lichens of Greenland. The Bryologist 85:64-73.

Branth, J.D. & Chr. Grønlund. 1888. Grønlands Lichen-Flora. Meddr. Grønland 3:447-513.

Böcher, T.W. 1954. Oceanic and continental vegetational complexes in southwest Greenland. Meddr. Grønland 148(1). 336 pp.

Dahl, E. 1950. Studies in the macrolichen flora of South West Greenland. Meddr. Grønland 150(2). 176 pp.

Dibben, M.J. 1980. The Chemosystematics of the Lichen Genus *Pertusaria* in North America North of Mexico. Milwaukee Public Museum, Milwaukee. 588 pp.

Fries, Th. 1870-1874. Lichenographia Scandinavica. Uppsala. 639 pp.

Galløe, O. 1910. Lichens from North-East Greenland (N. of 76°N. Lat.) collected by the "Danmark-Expedition" 1906-1908. Meddr. Grønland 43:181-191.

Gelting, P. 1955. A West Greenland *Dryas integrifolia* community rich in lichens. Svensk Bot. Tidskr. 49(1-2):295-313.

Hansen, E. Steen. 1982. Lichens from Central East Greenland. Meddr. Grønland. Bioscience 9. 33 pp.

Hansen, E. Steen. 1983. Additions to the lichen flora of Greenland. Mycotaxon 18, 2:483-494.

Hansen, E. Steen. 1984. Notes on new revisions of Greenlandic lichens II. Mycotaxon 21:299-314.

Hansen, E. Steen. 1986. New or interesting Greenland lichens III. Mycotaxon 26:173-186.

Hertel, H. 1986. Schedae ad Lecideaceae exsiccatae, Fasc. VII:9 (No. 159).

Lynge, B. 1923. Lichens collected on the north-coast of Greenland by the late Dr. Th. Wulff. Meddr. Grønland 64:281-288.

Lynge, B. 1937. Lichens from West Greenland, collected chiefly by Th. M. Fries. Meddr. Grønland 118 (8). 225 pp.

Lynge, B. 1940. Lichens from North East Greenland. II. Microlichens. Skr. Svalb. & Ishavet 81. 143 pp.

Magnusson, A.H. 1928. A monograph of the genus Acarospora. Kungl. Sv. Vet. Akademiens Handlingar. Tredje ser. 7(4). 400 pp.

Ozenda, P. & G. Clauzade. 1970. Les Lichens Étude Biologique et Flore Illustrée. Masson et Cie, Paris. 801 pp.

Poelt, J. 1969. Bestimmungsschlüssel europäischer Flechten. Cramer, Lehre. 757 pp.

Poelt, J. & M. Steiner. 1971. Über einige parasitische gelbe Arten der Flechtengattung Acarospora. Ann. Naturhistor. Mus. Wien 75:163-172.

Poelt, J. & A. Vězda. 1977. Bestimmungsschlüssel europäisher Flechten. Ergänzungsheft I. Cramer, Vaduz. 258 pp.

Poelt, J. & A. Vezda. 1981. Bestimmungsschlüssel europäischer Flechten. Ergänzungsheft II. Cramer, Vaduz. 390 pp.

Santesson, R. 1984. The lichens of Sweden and Norway. Stockholm and Uppsala. 333 pp.

Thomson, J.W. 1979. Lichens of the Alaskan Arctic Slope. University of Toronto Press. 314 pp.

Vainio, E.A. 1905. Lichenes expeditionis G. Amdrup (1898-1902). Meddr. Grønland 30:123-141.

Wirth, V. 1980. Flechtenflora. Eugen Ulmer, Stuttgart. 552 pp.

Zahlbruckner, A. 1922. Catalogus lichenum universalis. Band I. Leipzig. 696 pp.

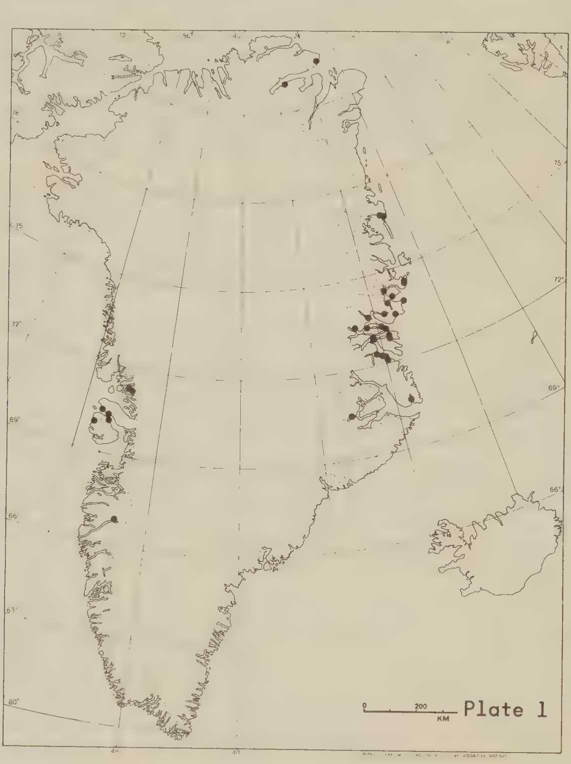


Plate 1. Distribution map of Fulgensia bracteata (Hoffm.) Räs. ssp. deformis (Erichs.) Poelt in Greenland.

Plate 2. Vegetative and reproductive structures of selected Greenland lichens. a: Acarospora stapfiana (Müll. Arg.) Hue. b: Arthrorhaphis vacillans Th.Fr. & Almq. ex Th.Fr. c: Fulgensia bracteata (Hoffm.) Räs. ssp. deformis (Erichs.) Poelt. d: Glypholecia scabra (Pers.) Müll.Arg. ► = apothecia. All figures c. x 20.

Plate 3. Vegetative and reproductive structures of selected Greenland lichens. e: Lecidea ileiformis Fr. f: Lempholemma myriococcum (Ach.) Th.Fr. g: Pertusaria atra Lynge. h: Phaeorrhiza sareptana (Tomin) Mayrhofer & Poelt var. sphaerocarpa (Th. Fr.) Mayrhofer & Poelt. ► = apothecia. All figures c. x 20.

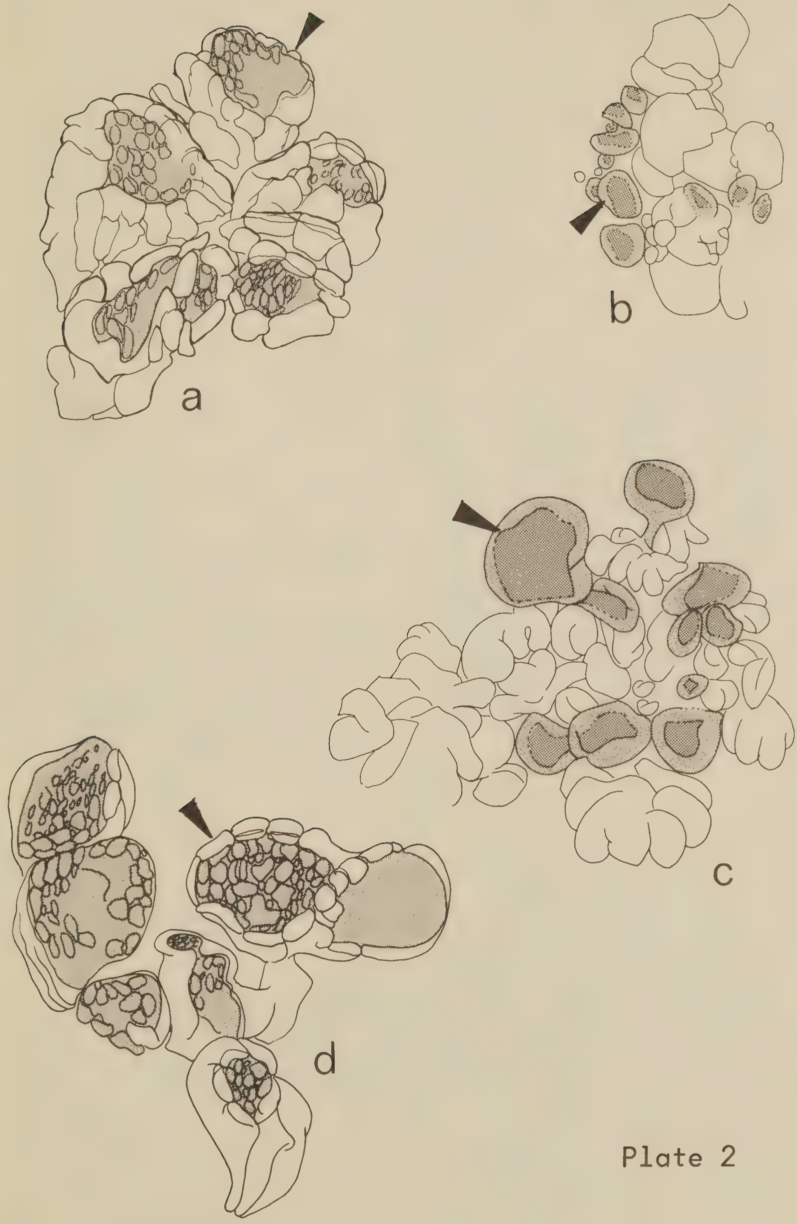


Plate 2

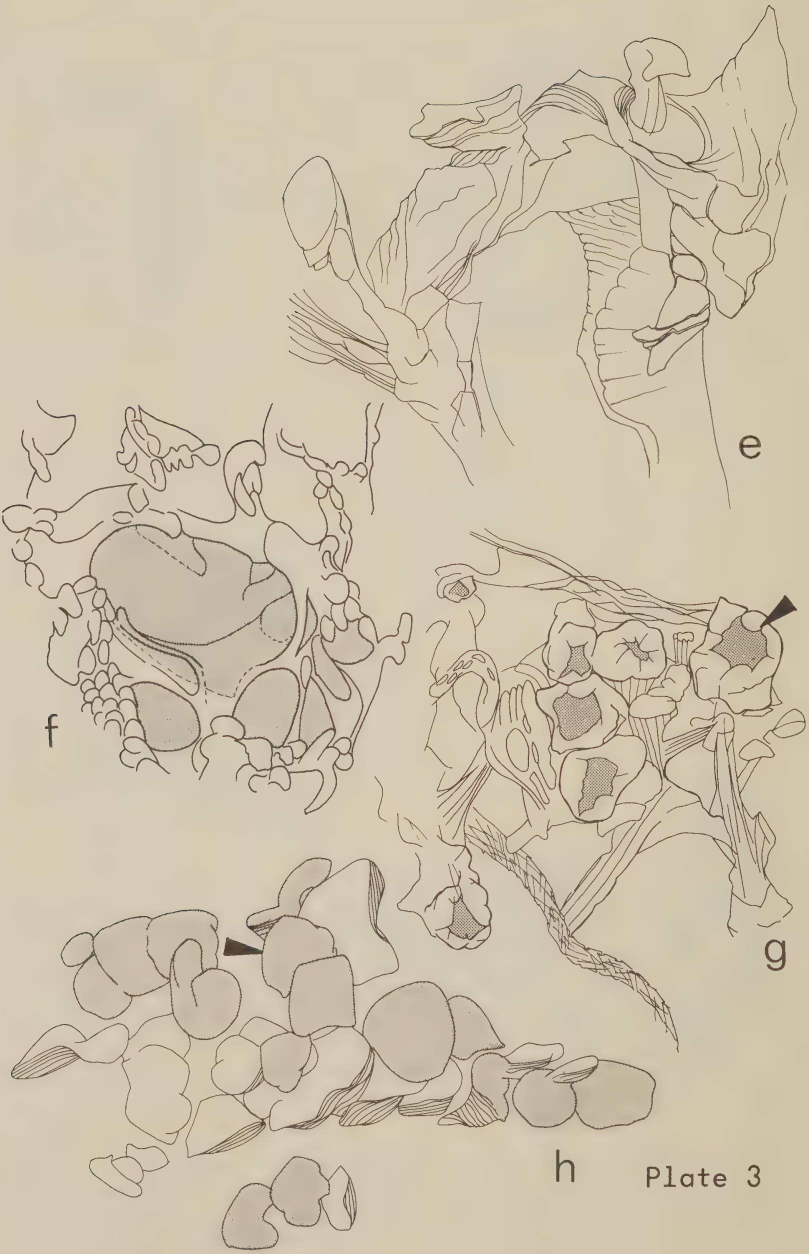


Plate 3

MYCOTAXON

Vol. XXX, pp. 81-85 October-December 1987

XYLARIA CORNIFORMIS RECONSIDERED

THOMAS LÆSSØE

Botanical Museum
Gothersgade 130, DK-1123 Copenhagen K, Denmark

Rogers (1983) in referring to the extensive misapplication of the name *X. corniformis* stated that 'progress in *Xylaria* taxonomy would be best served if the name *X. corniformis* were no longer applied to any taxon'. Since then, however, three collections assignable to *X. corniformis* have been made in Poland and, more significantly, at least one indisputable part of the type exists in B (ex. herb. Nitschke), and a similar part exists in K (ex herb. Cooke from Fries). The Friesian description (1828) refers to macroscopical differences between *X. corniformis* and *X. polymorpha* (Pers.: Fr.) Grev., but does not include the important micro-characters. He based the species on material from *Fagus*-logs in Småland, Sweden, of which some were sent to Kunze. Nitschke (1870) however, gave a complete and accurate description of the original material from herb. Kunze. The notes accompanying the material (in B) leaves no doubt about the fact that this material is identical to the material used by Nitschke for his description. Nitschke actually initiated some of the prevailing confusion by citing a collection in the Berkeley exsiccatum (British Fungi no. 277) as *X. corniformis* without even seeing it! Miller (1934) later discovered that the spores in this collection measured 10-15 x 4-6 µm and concluded that it was *X. longipes* Nits. This is probably the reason why Miller did not use the name *X. corniformis* for material with the characters described by Fries and Nitschke. According to Rogers (1983) Miller used the names *X. castorea* Berk. and *X. longipes* var. *microspora* ined. for similar fungi found in North America and elsewhere. Rogers (1983) adopted the name *X. curta* Fr. for similar material, though stressing a possible separating character found in the ectostroma, this being pronouncedly whitish squamulose in typical *X. curta* but darker brown in other material. He hesitated to synonymise *X. castorea* with *X. curta* mainly due to the lack of white squamules in *X. castorea*. The type of *X. castorea* came from New Zealand and judging from Roger's description and figures the material greatly resembles the European material of *X. corniformis* reported herein, and also matches a collection from Canada on *Fagus* in C (ex Cryptogamic Herbarium, University of Toronto no.

22930). Dennis (1971), like Rogers, abandoned the use of *X. corniformis* and instead used *X. feejeensis* (Berk.) Fr. subsp. *faveolis* (Lloyd) Dennis (as *Xylosphaera*) for specimens collected in the Soviet Far East. His description comes close to my concept of *X. corniformis*, but the material possibly intergrades with *X. curta*. Dennis (1961) presumed that *X. corniformis* was based on a slender state of *X. polymorpha*. However, he (Dennis 1984) later accepted a collection from Fries (in K) as authentic material of *X. corniformis* (material reported herein as part of the type). In spite of this Dennis did not comment on his earlier decision concerning the use of *X. corniformis*.

Many other synonyms and potential synonyms are available in this group, see e.g. Dennis (1961, 1971), but since *X. corniformis* is described in the sanctioning Elenchus Fungorum (Fries 1928), it is unlikely that any other name is valid for *X. corniformis* sensu stricto. In gross morphological characters *X. corniformis* mostly resembles species in the *X. polymorpha*-group (Rogers & Callan 1986). The collection reported under the name *X. feejeensis* subsp. *faveolis* by Candoussau (1976) from Béarn-Pays Basque probably represents *X. corniformis* sensu stricto. Bertault (1984) described both *X. alpina* Speg., *X. corniformis*, *X. curta* and *X. feejeensis* subsp. *faveolis* in his monograph of European and North African *Xylarias* but they may all be considered as belonging to *X. corniformis* in the sense applied here. Traverso (1906) accepted the species from all continents and mentioned the following hosts: *Alnus*, *Fagus*, *Olea*, and *Populus*, presumably based on European material. He accepted *X. alpina* on wood of *Abies* in Italy, but he noted its similarity to *X. corniformis*, and used only the stroma size as the separating character in his key.

Xylaria corniformis (Fr.) Fr., Summa vegetabilium Scandinaviae: 381, 1849.
Sphaeria corniformis Fr., Elenchus Fungorum 2:57, 1828.
Syntypes: B & K (ex herb. Fries).

Part in B.

Stroma broken into small fragments, crust with remnants of brownish floccose ectostroma, otherwise black with rather prominent, somewhat flattened papillate ostioles; entostroma pale woodish brown; perithecia c. 0.4 mm diam., somewhat elongate due to mutual pressure. Asci more or less disintegrated, ascus plugs seen only as amorphous blue bodies (in Melzer's reagent), c. 2 µm diam. Spores dark reddish brown, inequilaterally ellipsoid or slightly more slender at one end, some with traces of a cellular appendage at one end; germ slit straight, ventral, in full spore length, one large guttule, (8.0-)9.2-9.9 x 4.3-5.0 µm (Nitschke: 8-9 x 5 µm).

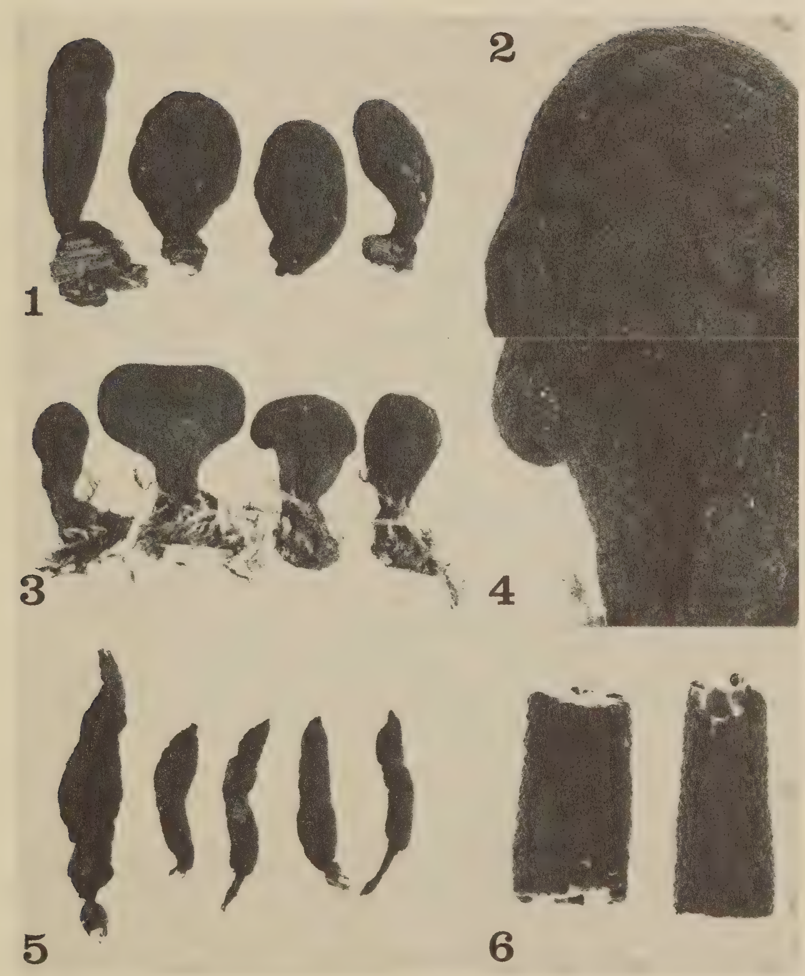


Fig. 1-2. *Xylaria corniformis*. TL-0943, Poland. Fig. 3-4. *X. corniformis*. TL-0944, Poland. Fig. 5. *X.* cfr. *corniformis*. E.Rald, Poland. Fig. 6. *Sphaeria corniformis*. Syntype (K). Fig. 1, 3 & 5 × 1. Fig. 2, 4 & 6 × 4.

Part in K Fig. 6

Two stroma pieces, slightly larger than those in B, with traces of brownish ectostromal squamules. Ascus plugs in good condition, dark blue, 1.3-1.5 x 1.5-1.8 µm, spores 9.2-9.9 (-10.6) x (4.3-)4.6-5.3 µm (Dennis 1984: 9-11 x 4-5.5 µm).

Description of some Polish collections. Fig. 1-4

No Swedish material besides the type and a form with sterile apices (see later) has so far been available, but on an excursion with the Danish Mycological Society to Białowieża in eastern Poland, October 1984, three collections assignable to *X. corniformis* were made (deposited in C).

TL-943 on a dead, fallen *Carpinus*-trunk and TL-944 on a similar unidentified trunk are very uniform and the following description includes both collections.

Stromata 20-35 x 5-20 mm, clavate or more often spathulate (like a beaver's tail), solitary or subfasciculate, shortly stipitate, with a prominent purplish brown, felty tomentose, basal bulb. Entostroma massive, white to greyish brown, soft spongy, fragile. Ectostroma with aggregated, tiny, light brown squamules. Ostioles small, rather inconspicuous, flattened papillate. Perithecia completely immersed, not or very slightly visible in outline, 0.3-0.5 mm diam.

Asci long stipitate, 140-160 µm long, p. sp. 60-70 µm, ascus plugs medium blue, inverted hat-shaped, 2 x 2.6 µm, spores (7.9-)8.6-9.9(-10.6) x 4.6-5.3(-5.6) µm, inequilaterally ellipsoid or ovoid, dark sooty brown, germ slit thin, ventral, in full spore length, a small cellular appendage present at one end of some spores, no visible perispore. (see Rogers (1968) for appendages on *X. curta* spores).

The stromata of the third Polish collection, TL-0972, are more robust and firm; one is strongly contorted-twisted, 33 x 31 mm, another is long stipitate. The microscopical characters are like those described above.

Additional material studied.

P. Sydow, Mycotheca Marchica 865, Forstrevier Cladow b/Candsberg a/w, 8. 1885, auf einem Buchen (*Fagus*) stamme (in HBG, sub *X. longipes* Nits.)

Abnormal (?) collections studied. Fig. 5

Two collections share the microscopical features described above, but have stromata with sterile apices:

J. Ax. Nannfeldt 3072, Sweden, Småland, Femsjö SE of Ålmås, 10.VIII.1929, on *Fagus* (in UPS, sub *X. corniformis*, det J.H. Miller) and E. Rald, Poland, Białowieża, 8.X.1984, on trunk (in C).

The Polish collection shows no remnants of ectostromal squamules and the perithecial outlines are evident on some stromata. Only a few mature spores are present in the Swedish collection. All cited material should probably be referred to *X. corniformis*, but more material is needed before the variation is completely understood.

Herbarium abbreviations follow Index Herbariorum, 1981.

Acknowledgements.

The herbarium curators at B, HBG, K and UPS are thanked for the loan of material.
Drs. A.J.S. Whalley, Liverpool Polytechnics and H. Knudsen, Botanical Museum, critically read the manuscript. M. Sasa revised the English language. H.F. Gøtzsche did the photographic work. O. Lansø typed the manuscript. All are thanked for their friendly support.

Literature.

Bertault, R. 1984: Xylaires d'Europe et d'Afrique du Nord. - Bull. Trimest. Soc. mycol. Fr. 100(2): 139-175.
Candoussau, F. 1976. Recolte de *Xylaria feejensis* (Berk.) Fr.) ssp. *faveolis* (Lloyd) Dennis. - Doc. Mycol. 6(24): 47-49.
Dennis, R.W.G. 1961. Xylarioideae and Thamnomycetoideae of Congo. - Bull. Jard. Bot. Nat. Belg. 31: 109-154.
Dennis, R.W.G. 1971. Some Xylariaceae from the Soviet Far East. In Parmasto, E.: Zhivaya Priroda Dal'nego Vostoka, 42-51.
Dennis, R.W.G. 1984. Some Ascomycetes from the Maghrib, North Africa. - Kew Bull. 39(4): 759-770.
Fries, E. 1828. Elenchus Fungorum 2. - Greifswald.
Miller, J.H. 1934, Xylariaceae. In: Chardon, C.E. & R.A. Toro. Mycological explorations of Venezuela. - Monographs of the University of Puerto Rico, series B, 2: 195-220.
Nitschke, T. 1870. Pyrenomycetes Germanici 1. - Breslau, 320 pp.
Rogers, J.D. 1968. *Xylaria curta*: cytology of the ascus. - Can. J. Bot. 46(11): 1337-1340.
Rogers, J.D. 1983: *Xylaria bulbosa*, *Xylaria curta*, and *Xylaria longipes* in continental United States. - Mycologia 75(3): 457-467.
Rogers, J.D. & B.E. Callan, 1986. *Xylaria polymorpha* and its allies in continental United States. - Mycologia 78(3): 391-400.
Traverso, J.B. 1906. Flora Italica Cryptogama. Pars 1. Fungi. Pyrenomycetae.

MYCOTAXON

Vol. XXX, pp. 87-95 October-December 1987

ENDOPHYTE-HOST ASSOCIATIONS IN FORAGE GRASSES. X. CULTURAL STUDIES ON SOME SPECIES OF ACREMONIUM SECT. ALBO-LANOSA, INCLUDING A NEW SPECIES, A. STARRII.

J.F. WHITE, JR.*

Department of Botany, University of Texas,
Austin, Texas 61801

and

GARETH MORGAN-JONES

Department of Plant Pathology, College of Agriculture and Alabama
Agricultural Experiment Station, Auburn University, Auburn, Alabama 36849

ABSTRACT

Comparative cultural studies on endophytes of grasses, namely *Acremonium coenophialum*, *A. huerfanum*, *A typhinum*, and a new species, *Acremonium starrii* White and Morgan-Jones, isolated from species of *Bromus*, *Elymus*, *Festuca*, *Poa*, and *Sphenopholis*, are reported. Taxonomic concepts in *Acremonium* section *Albo-lanosa* are further discussed and a key to presently accepted species is offered.

INTRODUCTION

White (1987), in a study of the biology and taxonomy of fungal endophytes of grasses, examined species representing ninety-three genera for their presence. Forty-three species, belonging predominantly to the subfamily Festucoideae, were found to harbor endophytes in culms and caryopses (seeds). Numerous endophyte-containing festucoid grasses were collected and the fungi isolated and examined in pure culture. Almost all isolates were referable to *Acremonium* Link section *Albo-lanosa* Morgan-Jones & W. Gams. It was anticipated that other fungi, such as *Atkinsonella hypoxylon* (Peck) Diehl and *Balansia epichloe* (Weese) Diehl, which have been reported to have an endophytic habit in grasses (Diehl, 1950), would also be found. However, they were not. An apparent explanation for this is contained in the recent report by Philipson and Christey (1985) which suggests that these fungi grow largely epiphytically, becoming endophytic only in flower parts. Some of the endophytes

*Present address: Department of Botany, The Ohio State University, Columbus, Ohio 43210

Alabama Agricultural Experiment Station Journal Series No. 18-871271

isolated could be identified as the previously described taxa *Acremonium coenophialum* Morgan-Jones & W. Gams (White and Cole, 1985; White *et al.*, 1987) and *A. typhinum* Morgan-Jones & W. Gams [teleomorph: *Epichloe typhina* (Fr.) Tul.], while others were found to be morphologically distinct from these two species. Isolates derived from seeds, stems and leaves of *Festuca versuta* Beal could not be induced to sporulate *in vitro* and were therefore not assigned to a species although found to have distinctive cultural characteristics (White and Cole, 1986). A number of isolates obtained from *Festuca arizonica* Vasey in Colorado were described by White *et al.* (1987) and given the name *Acremonium huerfanum* White, Cole & Morgan-Jones. These were found to be easily distinguished from other endophytes by having ochraceous to ochraceous-green colonies as well as some morphological differences. A third group of isolates, derived from *Stipa eminens* Cav. in Texas, was named *Acremonium chisosum* White & Morgan-Jones on account of an unique morphology, resulting from possession of percurrently proliferating conidiogenous cells (White and Morgan-Jones, 1987a).

In defining taxa at species level, shape and size of conidia, morphology of conidiogenous cells, and colony characteristics have been used as the main distinguishing criteria (Morgan-Jones and Gams, 1982; Latch *et al.*, 1984; White *et al.*, 1987; White and Morgan-Jones, 1987a). Comparative study of a number of isolates obtained from *Bromus anomalus* Rupr. and from several species of *Festuca* L. [isolation techniques were as described previously by Clark *et al.* (1983); White and Cole (1986)] have shown that they cannot be satisfactorily accommodated in any of the form-species named to date. The binomial *Acremonium starrii* is therefore established for them herein.

TAXONOMIC PART

Acremonium starrii White et Morgan-Jones, sp. nov. (Plate 1, C & D).

Coloniae in agaro decocto tuberorum lentissime crescunt, post 14 dies ad 25C, 18 mm diametro, albae, lanosae; reverso pallide brunneo. Hyphae vegetativae hyalinae, septatae, 1-2.5 µm latae. Cellae conidiogenae ex hyphis aeriis oriundae, discretae, singulae, laterales, orthotropicae, aculeatae, hyalinae, laeviae, determinatae, saepe procul a septis in hyphis basilaribus, sed plerumque septo basilari carentes, 15-31 µm longae, 1.5-2.5 µm crassae ad basim, 0.5-1 µm crassae ad apicem. Conidia allantoidea vel reniformia, basi modice truncata, apice paulo rotundato, hyalina, laevia, saepe transversaliter affixa, 4-7 X 1.5-3 µm. Chlamydosporae nullae. Telomorphosis ignota.

In culturis ex culmis Festucae subulatae, Elbe, Pierce Co., Washington, U.S.A. June 25, 1985, J.F. White, Jr., AUA, holotypus.

Colonies on PDA [Difco] (Plate 2, A, B & E) white, cottony, slow growing but highly variable in this regard, the type isolate attaining a diameter of 10 mm after 14 days at 22C, 18 mm at 25C and 16 mm at 28C. Colony reverse pale brown to tan centrally, concolorous marginally. Vegetative hyphae hyaline, septate, smooth, 1-2.5 µm wide. Conidiogenous cells (Plate 1, C) arising solitarily from aerial hyphae, produced sparsely, discrete, lateral, orthotropic, cylindrical over the lower one-third, attenuating gradually towards the apex, hyaline, smooth, determinate, not always originating in proximity to septa in the subtending hypha, usually not delimited by a basal septum, 15-31 µm long, 1.5-2.5 µm wide at the base, 0.5-1 µm wide at the extreme apex. Conidia holoblastic (?),

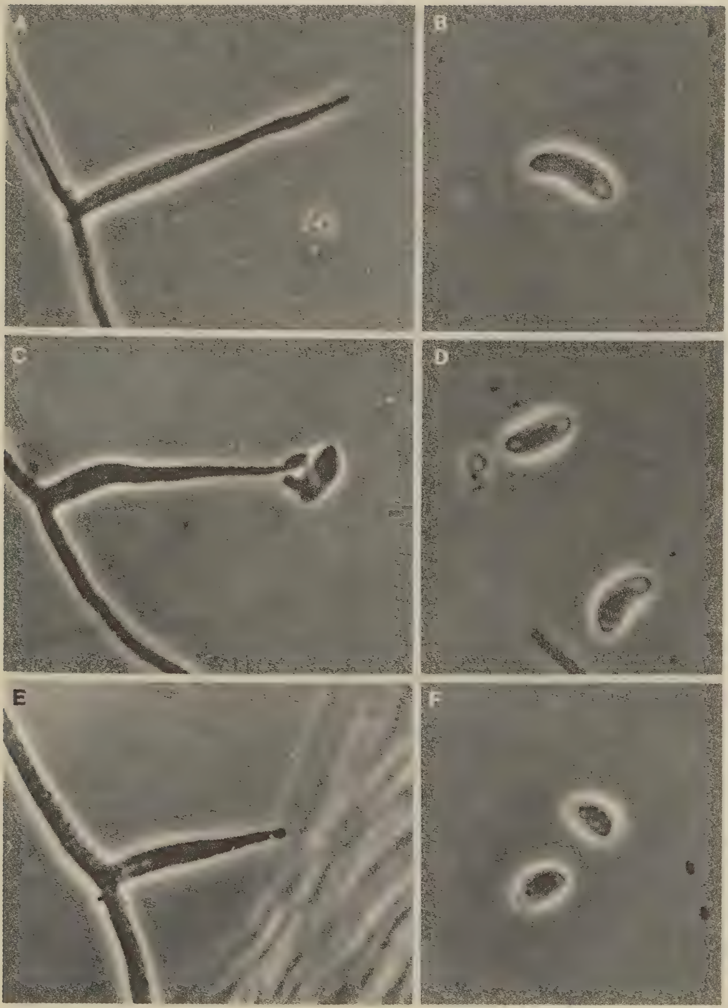


PLATE 1. Conidiogenous cells and conidia; A & B, of *A. coenophialum* from *P. autumnalis*; C & D, of *A. starrii* (type isolate); E & F, of *A. typhinum* from *E. canadensis* [all X 2200].

allantoid or narrowly reniform, slightly truncate at the base, obtuse at the apex, hyaline, smooth, frequently oriented transversely across the conidiogenous cell tip following detachment, 4-7 X 1.5-3 µm. Chlamydospores absent. Teleomorph unknown.

Named in honor of Dr. Richard C. Starr, Department of Botany, University of Texas at Austin.

In seeds, leaf sheaths and culms of *Bromus anomalus*, *Festuca arizonica*, *F. obtusa* Spreng. and *F. subulata* Trin.; North America.

Collections examined: from *B. anomalus*, Iron Mtn Ranch, Brewster Co., Texas, July 28, 1985, AUA, and Chisos Mts, Brewster Co., Texas, August 1, 1985, AUA; from *F. arizonica*, Egar, Apache Co., Arizona, June 15, 1985, AUA, and Guadalupe Mts, Culberson Co., Texas, July 4, 1985, AUA; on *F. obtusa*, Dallas, Dallas Co., Texas, June 1, 1985, AUA; on *F. subulata*, Elbe, Pierce Co., Washington, June 25, 1985, AUA, type; (all by J.F. White, Jr.).

Details of cell wall relationships during conidiogenesis in *A. starrii*, as is the case with other species described previously (cf. White and Morgan-Jones, 1987a), are difficult to determine because of the small size of the conidiogenous cell apex. As indicated in the diagnosis, it is uncertain whether or not conidia are produced holoblastically or enteroblastically. Although the conidiogenous cells have the aspect typical of phialides in terms of shape, no break between their periclinal wall and that of developing conidia is readily apparent. Each conidiogenous cell in *A. starrii* produces a few conidia, however.

COMPARATIVE CULTURAL STUDIES

Data from observations of microscopic characteristics of thirteen fungal endophytes isolated from nine hosts (representing five grass genera) are listed in Table 1. From this it will be noted that isolates which we classify under the name *A. starrii* produce conidia that are intermediate in size between those of *A. coenophialum* and *A. typhinum*. The taxon differs from these and other species of *Acremonium* sect. *Albo-lanosa* in some other characteristics also. It differs from *A. typhinum* in consistently producing longer, flexuous, aculeate, generally more attenuated conidiogenous elements (cf. Plate 1, B & E) than is characteristic of that species *in vitro*, and in possessing longer conidia. As is the case in *A. coenophialum*, the lateral conidiogenous element in *A. starrii* is usually not delimited from its parent hypha by a transverse septum. In *A. typhinum* a septum is normally present. Presence or absence of a septum at the base of a fertile lateral hyphal element as a distinguishing criterion should, however, be treated with caution since there is some variability between isolates in this regard. Latch *et al.* (1984) found isolates of *A. typhinum* from *Festuca rubra* L. in New Zealand to lack a septum. In the present study, conidiogenous elements in the *A. starrii* and *A. coenophialum* isolates have occasionally been found to be delimited by septa while, although rarely, absence of a septum has been observed in *A. typhinum*. White and Morgan-Jones (1987b) showed that conidia of *A. typhinum*, produced both *in vivo* on grass hosts and *in vitro* on PDA, have a relatively constant shape and size and this is substantiated in the present study as well as by the previous accounts of Morgan-Jones and Gams (1982) and Latch *et al.* (1984). The conidia of *A. starrii* are shorter than those of *A. coenophialum* and the conidiogenous elements of the latter tend to be a little longer and, although this is not the case in all isolates, less noticeably

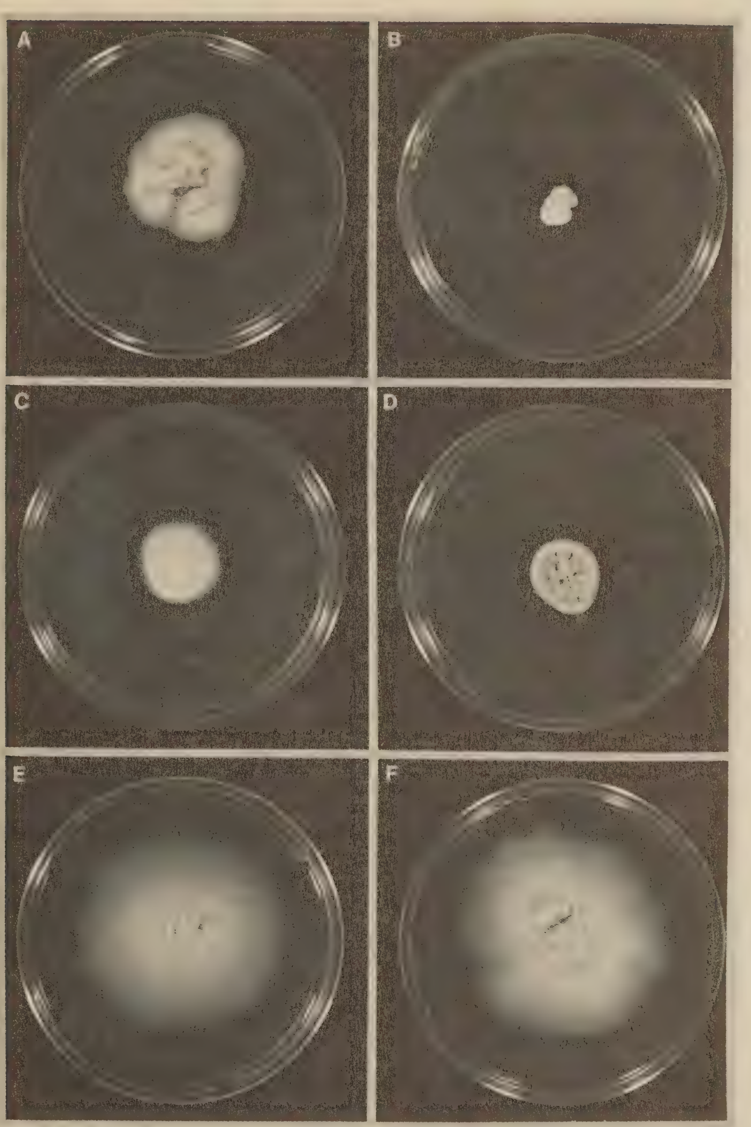


PLATE 2. 35-day-old colonies on PDA at 25C; A, *A. starrii* from *B. anomalus* (Chisos Mts); B, *A. starrii* from *B. anomalus* (Iron Mtn); C, *A. coenophialum* from *P. autumnalis*; D, *A. coenophialum* from *F. arundinacea* (Marshall, TX); E, *A. starrii* from *F. arizonica* (Davis Mts); F, *A. typhinum* from *E. canadensis* (Austin, TX).

TABLE 1. CONIDIOGENOUS CELL AND CONIDIAL DIMENSIONS (ON PDA)

	ENDOPHYTE	HOST	COLLECTION LOCATION	CONIDIOGENOUS CELL LENGTH*	CONIDIUM SIZE
1	*A. coenophialum*	*F. arundinacea*	Marshall, TX	10-26 (19.5)	8-13 X 2-3
2	*A. coenophialum*	*F. arundinacea* cultiv. Triumph	(commercial seed)	15-37 (25.0)	7-10 X 1.5-3
3	*A. coenophialum*	*P. autumnalis*	Angleton, TX	20-25 (22.0)	6.5-9 X 1.5-3
4	*A. huerfanum*	*F. arizonica*	Rocky Mts, CO	10-20 (14.5)	3-4 X 2-2.5
5	*A. starrii*	*B. anomalus*	Chisos Mts, TX	20-40 (32.0)	5.5-7 X 2-3
6	*A. starrii*	*B. anomalus*	Iron Mtn, TX	19-23 (21.0)	5-6 X 2.0-2.5
7	*A. starrii*	*F. arizonica*	Egar, AZ	15-28 (20.0)	5-7 X 2-3
8	*A. starrii*	*F. arizonica*	Davis Mts, TX	14-27 (20.0)	4-6 X 2-2.5
9	*A. starrii*	*F. obtusa*	Dallas, TX	12-21 (16.5)	5-5.5 X 1.5-3
10	*A. starrii*	*F. subulata*	Elbe, WA	15-31 (23.0)	4-7 X 1.5-3
11	*A. typhinum*	*E. canadensis*	Austin, TX	14-25 (19.0)	3.5-4.5 X 2-3
12	*A. typhinum*	*E. canadensis*	Dallas, TX	12-20 (15.5)	3-4 X 1.5-2.5
13	*A. typhinum*	*S. obtusata*	Athens, GA	15-19 (17.0)	2.5-4 X 1.5-3

* in μm, average of 20 measurements in parenthesis.

attenuated. *Acremonium lolii* [as *A. loliae*] Latch, Christensen & Samuels, a species not isolated during the course of this study, has conidia of similar size to those of *A. starrii* (cf. Latch, *et al.*, 1984). It differs from the latter in the morphology of its conidiogenous cells. In that species, lateral fertile elements (sometimes in the form of septate conidiophores) are long [up to 110 μm fide Latch *et al.* (1984)] and are slender, cylindrical and hypha-like throughout most of their length, attenuating only slightly toward their apex.

Colony growth rate has been used to some extent as an additional criterion in defining species. Morgan-Jones and Gams (1982) reported *A. typhinum* to grow appreciably faster than *A. coenophialum*, as did Latch *et al.* (1984). This has been confirmed in the present study (see Plate 2, C, D & F and Figure 1). Temperature/growth relationships of isolates were determined by measuring increase in diameter of 14-day-old colonies following a further two-week period at three different temperatures (Figure 1) [readings from three colonies at each temperature treatment were averaged]. Growth rate appears now to have limited applicability in distinguishing taxa, since variability among isolates of the same species, especially of *A. starrii* (see Plate 2, A, B & E and Figure 1), is considerable. One isolate of *A. starrii* (that from *B. anomalus* collected at Iron

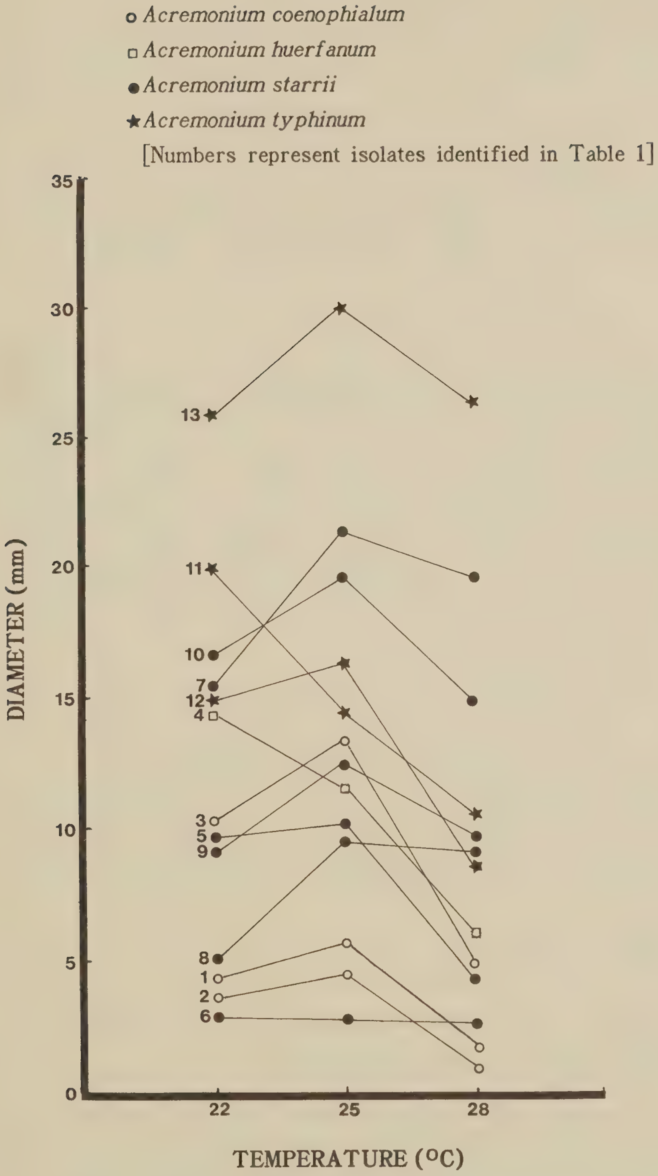


FIGURE 1. Endophyte colony growth after 14 days on PDA

Mtn) grows extremely slowly, whereas others have a growth rate intermediate between that of *A. coenophialum* and *A. typhinum*. In general, isolates grow faster at 25C than at the other temperatures tested. The isolate of *A. typhinum* from Austin, Texas and that of *A. huerfanum*, however, grow much faster at 22C than at the higher temperatures. In this connection it is interesting to note that in *Festuca arizonica*, collected in Colorado at an elevation with cool temperatures, the endophyte present was *A. huerfanum* (White *et al.*, 1987). The same host, collected in Arizona and Texas, contained strains of *A. starrii* that grow better at 25C than at 22C (see Table 1/Figure 1). In spite of our recent findings, the temperature/growth criterion still seems to be useful in differentiating some species. At all three temperatures, *A. typhinum* grows faster than *A. coenophialum*. The data of Latch *et al.* (1984), show that the latter grows faster than *A. lolii* on PDA at both 20C and 25C.

DISCUSSION

The decision to establish a number of binomials for endophytes of pasture grasses has been reached after considerable deliberation. As has been discussed previously (White and Morgan-Jones, 1987b), this is a difficult group of fungi to classify. The alternative of referring to morphologically, culturally, and biologically divergent elements as biotypes of one species seems an unsatisfactory solution, especially since consistent differentiating characteristics exist among them. A similar degree of difference occurs between taxa in this section and those recognized in other sections of the genus *Acremonium*. Although classified in *Acremonium*, which is recognized as a heterogeneous entity, the fungal endophytes described to date are not thought to have a close natural relationship to species classified in other sections of the genus. In order to facilitate assignment of isolates to presently accepted species, the following key is offered:

KEY TO SPECIES OF *ACREMONIUM* SECT. *ALBO-LANOSA*

[Based on cultural characteristics after 6 weeks on PDA (Difco) at 25C.]

1a. Colonies ochraceous to pale olivaceous, zonate.................... *A. huerfanum*
1b. Colonies white.. 2

2a. Conidiogenous cells proliferating percurrently...................... *A. chisosum*
2b. Conidiogenous cells determinate... 3

3a. Conidia 2.5-4.5 µm long.. *A. typhinum*
3b. Conidia 4-7 µm long.. 4
3c. Conidia 6.5-13 µm long.. *A. coenophialum*

4a. Colonies waxy, lacking aerial mycelium, conidiogenous cells long, hypha-like.. *A. lolii*
4b. Colonies lanose, conidiogenous cells aculeate........................... *A. starrii*

Comprehensive descriptions of these species have been published as follows: *A. coenophialum* (Latch *et al.*, 1984; White and Cole, 1985), *A. chisosum* (White and Morgan-Jones, 1987a), *A. huerfanum* (White *et al.*, 1987), *A. lolii* (Latch *et al.*, 1984), *A. typhinum* (White and Morgan-Jones, 1987b).

ACKNOWLEDGMENT

We wish to thank Dr. Michael R. Tansey, Department of Biology, Indiana University, Bloomington, for reviewing the manuscript and offering a number of useful suggestions.

LITERATURE CITED

CLARK, E.M., J.F. WHITE, JR. and R.M. PATTERSON. 1983. Improved histochemical techniques for the detection of *Acremonium coenophialum* in tall fescue and methods of *in vitro* culture of the fungus. *J. Microbiol. Methods* 1: 149-155.

DIEHL, W.W. 1950. *Balansia* and the Balansiae in America. *U.S. Dep. Agric. Monogr.* No. 4. 82 pp.

LATCH, G.C.M., M.J. CHRISTENSEN and G.J. SAMUELS. 1984. Five endophytes of *Lolium* and *Festuca* in New Zealand. *Mycotaxon* 20: 535-550.

MORGAN-JONES, G. and W. GAMS. 1982. Notes on Hyphomycetes. XLI. An endophyte of *Festuca arundinacea* and the anamorph of *Epichloe typhina*, new taxa in one of two new sections of *Acremonium*. *Mycotaxon* 15: 311-318.

PHILIPSON, M.N. and M.C. CHRISTEY. 1985. An epiphytic/endophytic fungal associate of *Danthonia spicata* transmitted through the embryo sac. *Bot. Gaz.* 146: 70-81.

WHITE, J.F., JR. 1987. Biology and taxonomy of *Acremonium* section *albo-lanosa*. Ph.D. Dissertation, University of Texas at Austin. 157 pp.

WHITE, J.F., JR. and G.T. COLE. 1985. Endophyte-host associations in forage grasses. II. Taxonomic observations on the endophyte of *Festuca arundinacea*. *Mycologia* 77: 483-485.

WHITE, J.F., JR. and G.T. COLE. 1986. Endophyte-host associations in forage grasses. IV. The endophyte of *Festuca versuta*. *Mycologia* 78: 102-107.

WHITE, J.F., JR., G.T. COLE and G. MORGAN-JONES. 1987. Endophyte-host associations in forage grasses. VI. A new species of *Acremonium* isolated from *Festuca arizonica*. *Mycologia* 79: 148-152.

WHITE, J.F., JR. and G. MORGAN-JONES. 1987a. Endophyte-host associations in forage grasses. VII. *Acremonium chisosum*, a new species isolated from *Stipa eminens* in Texas. *Mycotaxon* 28: 179-189.

WHITE, J.F., JR. and G. MORGAN-JONES. 1987b. Endophyte-host associations in forage grasses. IX. Concerning *Acremonium typhinum*, the anamorph of *Epichloe typhina*. *Mycotaxon* 29: 489-500.

MYCOTAXON

Vol. XXX, pp. 97-100 October-December 1987

ASTEROMIDIUM TABEBUIAE SP.NOV. FROM BRAZIL

F. A. Ferreira and J. J. Muchovej

Departamento de Fitopatologia
Universidade Federal de Viçosa
36570, Viçosa, MG, Brazil

SUMMARY

A large spored species of *Asteromidium* is reported as new. The fungus was found sporulating in leaf spots of *Tabebuia serratifolia* in Brazil.

A leaf spot of yellow Ipê (*Tabebuia serratifolia* (Vahl) Nichol.) was reported from Belém, Brazil as being caused by an *Asteromidium* species (Tabosa & Albuquerque, 1977). Later collections by Ferreira and A. C. Alfenas in 1978 were made from the same host plant. Alfenas in 1986 and 1987 collected similar leaf spots on Ipê-Ovo-de-Macuco in Linhares, Espirito Santo. These spots bore acervuli which were identified as belonging to the same *Asteromidium* species collected in Belém.

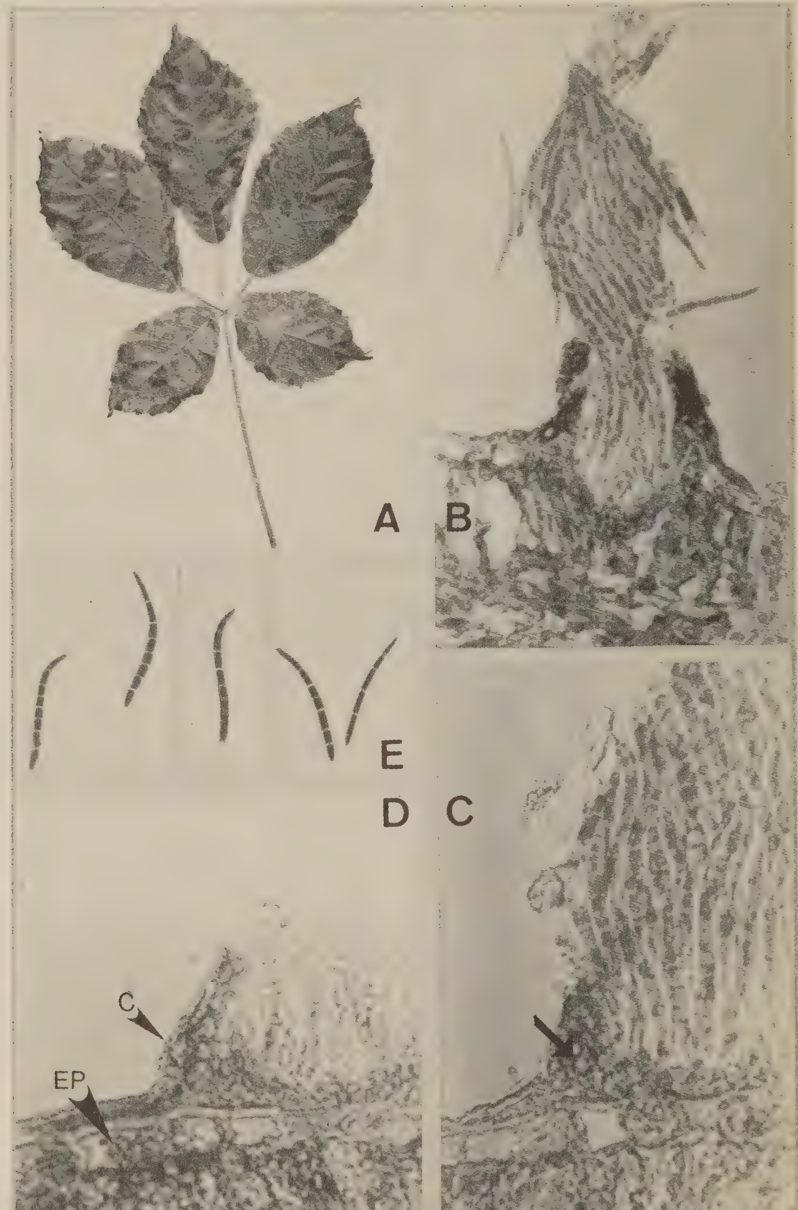
Asteromidium Speg. is a genus of acervular Coelomycetes which produces conidia from holoblastic conidiogenous cells (Sutton, 1980). Two species have so far been assigned to the genus and both have small conidia measurements. The species obtained in Belém and Linhares has larger conidia and is thus significantly different.

Asteromidium tabebuiae sp.nov. Fig. 1A-E.

Conidiomata acervularia, singularia, subcuticularia, ex textura angularibus composita. Cellulae conidiogenae cum 1-2 proliferationibus holoblasticis sympodialibus. Conidia holoblastica, laevia, curvata, hyalina, cylindrica vel fusiformia, basim truncata, apice rotundata, 3-8 euseptata, 36.5-90 x 3.6-5.6 µm.

Brazil, Espirito Santo, Linhares, in foliis *Tabebuia serratifolia*, A. C. Alfenas, 5 March 1987, Herbario UFV holotypus (isotypus: IMI 314490).

The conidiomata are acervular, subcuticular, up to 160 µm, separate, doliiform, composed of textura angularis at the base and between the epidermis and the cuticle.


A
B
E
D
C
C
EP

Dehiscence is irregular. Conidiogenous cells are discrete, hyaline, smooth with up to 2 sympodial holoblastic proliferations, 4-12 x 3-4 µm. Conidia are smooth, curved, hyaline, 3-8 septate, 36.5-90 (average 60.7) x 3.6-5.6 (average 4.3) µm.

Asteromidium imperspicuum Speg. was described from Paraguay as producing acervuli which are subcuticular and having conidia that were 3 septate, measuring 21-25 x 3 µm. *Asteromidium secundum* Batista & Peres was described from Venezuela with superficial pycnidia and 3-5 septate conidia measuring 20-45 x 3-4 µm. The species on *Tabebuia* has much longer 3-8 septate conidia and a typical subcuticular acervulus. The subcuticular nature is evident in Fig. 1C-D where the undulated cuticle can be seen above the conidioma. In some instances, the tissue is actually anchored deeply within the mesophyll and this gives the impression that the conidioma is pycnidial (Fig. 1B) especially when observed at low power. Acervuli can be seen on both sides of the host leaf.

The genus as redescribed by Sutton (1980) will accommodate *A. tabebuiae* with differences at the species level being mostly conidial size. The fungus described by Batista & Peres (1959) has conidiomata that appear to be of a pycnidial origin and superficial so their species should probably be reassessed.

The leaf lesions produced by *A. tabebuiae* are initially dark in color and then become light in the centers but maintain a distinct margin consisting of a thick (1-1.5 mm) dark band which diffuses into the living tissue. Lesions are circular to irregular and up to 2 cm in size (Fig. 1A). Sporulation is visible under humid conditions with an orange-colored cirrhus of conidia being produced from the conidiomata (Fig. 1B). These leaf spots are of considerable importance on nursery grown plantings.

The taxonomy of the host plant for *A. tabebuiae* is in need of revision. While Rizzini (1971) has yellow Ipê and

---

Fig. 1 *Asteromidium tabebuiae*. A. leaf spots x 0.2; B. cross section of acervulum, note cirrhus and deep rooting of the acervulus in the mesophyll x 255, C. cross section of acervulus showing angular texture (arrow) x 500; D. cross section of acervulus showing cuticle (arrowhead C) separated from the epidermis (arrowhead E) x 500; E. conidia x 240.

Ipê-Ovo-de-Macuco as conspecific, other athors (Anon., 1984 regard Ipê-Ovo-de-Macuco as *Tabebuia* sp.

The fungus is slow growing requiring more than 2 weeks for sporulation to occur in culture.

ACKNOWLEDGEMENTS

We thank Dr. B. C. Sutton for reviewing and improving the quality of this manuscript. Also, grateful thanks are due to Dr. A. C. Alfenas for his help in the collection of material.

REFERENCES

Anon., 1984. Listagem das espécies arboreas identificadas na reserva florestal, Companhia do Valle do Rio Doce, Linhares, ES. 17 pp.

Batista, A. C., Peres, G. E. P., and Maia, H. S. 1959. Novas espécies de *Gelatosphaera*, *Asteromidium* e *Septoria* e antigas espécies de Sphaeropsidaceae. Instituto de Micologia, Universidade de Recife, Pernambuco. Publicação 214.

Rizzini, C. T., 1971. Árvores e madeiras úteis do Brasil. Editora Edgard Beucher Ltda. São Paulo. pp 39-41.

Sutton, B. C., 1980. The Coelomycetes. CMI, Kew. pp 241-242.

Tabosa, S. A. S., and Albuquerque, F. C., 1977. Manch escura das folhas, nova enfermidade do Ipê (*Tecoma serratifolia*) no est. Pará, Brasil. Fitopatologia Brasileira 2:104-105 (abstract).

MYCOTAXON

Vol. XXX, pp. 101-116 October-December 1987

ON THE NOMENCLATURE OF THE EUROPEAN SPECIES OF THE ARMILLARIA MELLEA GROUP[1]

AAD TERMORSHUIZEN[2] AND EEF ARNOLDS

Agricultural University Wageningen
Biological Station, Section of Forest Ecology
Kampsweg 27, 9418 PD Wijster, The Netherlands

ABSTRACT

The names of taxa described from Europe in the *Armillaria mellea* group are listed and a critical analysis of their actual identity is made. Special attention is paid to pre-Friesian names. On the basis of this study the current names *Armillaria obscura* (Pers. ex Secr.) Herink and *A. bulbosa* (Barla) Kile & Watling are rejected, the correct names being *A. ostoyae* Romagn. and *A. lutea* Gillet, respectively. The type collections of the recognized taxa are indicated. A key for the identification of basidiocarps of the European biological species in this group is added.

KEYWORDS: *Armillaria,* nomenclature, biological species, key.

INTRODUCTION

In 1978, Korhonen unravelled the so-called *Armillaria mellea* complex in North-West Europe by means of interfertility tests of mycelia in pure culture. He was able to recognize five biological species, indicated as species A, B, C, D and E, respectively. It appeared to be possible, at least to a large extent, to distinguish these species also on the basis of morphological and anatomical characteristics of the basidiocarps (e.g. Marxmüller, 1982; Romagnesi & Marxmüller, 1983). At present the most regularly used names are *Armillaria borealis* Marxm. & Korh. in Marxmüller (species A), *A. cepistipes* Velen. (species B), *A. obscura* (Pers. ex Secr.) Herink (species C), *A. mellea* (Vahl: Fr.) Kumm. (species D) and *A. bulbosa* (Barla) Kile & Watl. (species E), respectively.

---

[1] Comm. no. 329 of the Biological Station, Dr. W. Beijerinck, Wijster.

[2] Present address: Dept. of Phytopathology, Binnenhaven 9, 6709 PD Wageningen.

In the scope of the preparation of the Flora agaricinum neerlandicum (see Bas, 1983) we made a revision of the genus *Armillaria* in The Netherlands, paying special attention to the correct nomenclature of the taxa. In view of the changes in nomenclatural rules adopted at the Sydney congress (Voss & al., 1983) we focused mainly on pre-Friesian names. We have been very careful in identifying old descriptions with Korhonen's species since the differences in macroscopic characters are rather subtle and most early descriptions are far from being complete. Moreover, strong arguments are needed to replace an established name, sometimes documented with a type collection, by an obscure name from the eighteenth or nineteenth century without any material left. In this paper we will discuss the available European names in alphabethical order of the epithets.

In addition the senior author studied the field ecology and geographical distribution of the various species in the Netherlands (Termorshuizen, 1984, 1985; in prep.).

GENERIC NAME

We support the opinion of Watling & al. (1982) and prefer the name *Armillaria* (Fr.: Fr.) Staude above *Armillariella* (P. Karst.) P. Karst.

KEY TO THE EUROPEAN SPECIES OF THE *ARMILLARIA MELLEA* GROUP

Note: With this key 'normal' basidiocarps can be identified, that is to say about 95 % of the populations occurring in nature. In addition several abberant forms exist, especially with regard to the veil development. Some of them were described by Marxmüller (1982). In doubtful cases interfertility tests remain necessary (Korhonen, 1978), except for *A. mellea* s.str., which can always be recognized by the absence of clamps.

1. Basidia without clamp connections. Annulus membranaceous, thick, persistent, usually yellowish beneath, smooth or with few, pale flocks. Basidiocarps densely fasciculate, with cylindrical stipes. Pileipellis made up of subradial, ascending hyphae, subhorizontal at the surface; in addition with ascending to erect hyphal tips of the scales. Pigment intracellular ....

A. mellea (Vahl : Fr.) Kumm.(species D)

1.* Basidia, at least in part, with clamp connections. Annulus cortiniform or membranaceous, in that case thinner or/and with dark flocks. Basidiocarps less densely fasciculate or solitary, often thickened downwards or bulbous. Pileipellis made up of irregular, interwoven hyphae, ascending near the surface, in addition with ascending to erect hyphal tips of the scales. Pigment predominantly membranal **2**

2. Veil cortiniform, leaving a fibrillose, fugacious annulus on the stipe 3

3. Pileus usually rather pale orange-brown or pale brown with slightly darker centre, squamulose all over, more densely so at the centre; scales concolorous or slightly darker as ground colour. Stipe often with many yellow flocks. Cells in the scales of the pileus averaging 38-72 µm, mostly a considerable proportion (10-55 %) over 60 µm long ....
A. lutea Gillet (species E)[3]

3.* Pileus in young basidiocarps usually dark brown, then fading, minutely dark squamulose, often at centre only, contrasting with paler ground colour in mature pileus. Stipe fibrillose, rarely with a few, fugacious flocks. Cells in the scales of the pileus averaging 30-43 µm, at the most a small proportion (< 15 %) over 60 µm long ....
A. cepistipes Velen. (species B)[3]

2.* Veil membranaceous or submembranaceous, leaving a distinct annulus on the stipe 4

4. Pileus yellowish to ochre brown with small, concolorous or slightly darker scales. Stipe slender, first with yellowish to pale brown flocks. Annulus whitish, margin and/or underside with yellowish to pale brown scales ....
A. borealis Marxm. & Korh. (species A)

4.* Pileus some shade of brown, often dark reddish brown, never yellowish, with prominent, brown to blackish scales. Stipe usually more thick-set, with, at least in part, brown to blackish flocks. Annulus white, margin and/or underside with large, brown to black scales ....
A. ostoyae Romagn. (species C)

---

[3] According to our experience it is often difficult and sometimes impossible to identify the basidiocarps of *A. lutea* and *A. cepistipes*. Since a morphological species concept is applied in the Flora agaricina neerlandica these taxa in fact should not be recognized in the rank of species. However, no formal taxonomic rank is available at present for genetically isolated, but morphologically similar or intergrading races. Perhaps the rank of subspecies comes closest, but we rather prefer to wait until the introduction of a new rank, which in our opinion would be very useful. For the time being we maintain them as species.

DISCUSSION OF THE AVAILABLE EPITHETS POSSIBLY BELONGING TO *ARMILLARIA MELLEA* AGG.

Note: In the past the concept of the genus *Armillaria* has been much wider, including the majority of white-spored, annulate agarics with broadly adnate to decurrent lamellae. Most of these species have nothing to do with *Armillaria* in the present, restricted concept, but belong to several other genera of the Tricholomataceae, such as *Tricholoma, Cystoderma, Catathelasma, Oudemansiella, Kuehneromyces* and even to the Pleurotaceae, such as *Pleurotus*. Most of these epithets are enumerated by Saccardo (1887) and are not discussed here.

The epithets of species and varieties are discussed in alphabetical order.

annularius: *Agaricus annularius* Bull. was listed by Fries (1821) as a synonym of *Agaricus melleus*. The description by Bulliard (1788:626) represents this species in a broad sense. He referred to three plates: 377, 540 (fig. 3) and 543. In our opinion plate 377 may very well represent *Armillaria mellea* s.str. (species D). According to Watling & al. (1982) plate 540, fig. 3, suggests *A. borealis* (species A), but in our opinion this identity is dubious. Plate 543 shows basidiocarps with a smooth pileus and strongly squamulose stipe and may refer to *Pholiota*.

Whatever it may be, *A. annularius* Bull. is not important from a nomenclatural point of view since it is antedated by *A. annularius* Schaeff. (= *Suillus luteus* (L.:Fr.) S.F. Gray), and therefore an illegitimate homonym (Petersen, 1977).

annularius luteus: *Agaricus annularius luteus* Secr. (1833:50) is an invalid name (ICBN, art. 23, 6c). Secretan (l.c.) distinguished three varieties: A, B and C. In our opinion var. C represents *Armillaria mellea* (species D); var. A may very well be *A. borealis* (species A), whereas the identity of var. B is unknown to us.

borealis: *Armillaria borealis* Marxm. & Korh. in Marxmüller (1982:122) was described to give a formal name to Korhonen's species A. The holotype is deposited in Herbarium Monacensum (M). See also discussion on *A. mellea*.

bulbosa: Barla (1887:143; 1888: pl. 22, fig. 3-7) described *Armillaria mellea* var. *bulbosa* as a taxon with a yellowish pileus, covered with brown fibrils, a fibrillose, reddish stipe, thickened at the base and a fibrillose, thin, ochre or pale brown ring, growing solitary or in small groups among moss under coniferous trees. In view of the fugacious ring this fungus is either species B or E. The entirely scaly pileus, the stipe without a strong bulb and the terrestrial habitat suggest species E, as suggested before by Korhonen (1978) and Marxmüller (1982). Kile & Watling (1983) made the valid combination *Armillaria bulbosa* (Barla) Kile & Watl.

However, this name is antedated by *Armillaria lutea* Gillet (see that epithet).

caeruleo-viridis: *Agaricus caeruleo-viridis* was described by Briganti (1837:9) in his tribe *Lepiota* as a solitary mushroom with a scaly stipe. The accompanying drawing shows structures at the stipe base which may represent rhizomorphs, but in our opinion may be attached twigs as well. It is even doubtful whether this fungus is an *Armillaria*.

casimiri: *Armillaria casimiri* Velen. (1920:283, translation by Pilát, 1948:86) is a solitary-growing fungus with a large, double annulus and a pileus with large, white marginal scales, suggesting identity with *Catathelasma imperiale* (Fr.) Sing. Anyway it is not one of the known species of the *A. mellea* group. A study of the type, if existing, is necessary to confirm our suggestion.

cepistipes: *Armillaria cepistipes* Velen.[4] (1920:283, pl. 30, fig. 10; translation by Pilát, 1948:86) was described as a very small fungus, growing on a twig, the pileus with very small, darker scales, the stipe very long with a curved, strongly bulbous base with fugacious scales and with a small, white annulus as the remains of an abundant cortina.

Romagnesi & Marxmüller (1983) identified *A. cepistipes* as species B on the basis of Velenovsky's description, although the size and stature of his basidiocarps strongly deviated from most populations of species B, having a habit similar to *A. lutea*. Besides, Romagnesi & Marxmüller (l.c.) stressed the fact that species B is characterized by the concentration of scales at the centre of the pileus. In contrast, Velenovsky (l.c.) described and depicted *A. cepistipes* with few, small scales, scattered on the entire pileus. However, one aberrant collection, reminiscent of Velenovsky's fungus, appeared to be interfertile with species B tester strains. This collection was indicated as neotype of *A. cepistipes*.

Antonin (1986) studied the still existing holotype of *A. cepistipes* (PR) and considered the holotype and the (superfluous) neotype as conspecific. Therefore we feel obliged to accept the very unfortunate situation, that the name of species B is based on an aberrant, hardly recognizable form, wheras the 'typical' form has to be indicated as *A. cepistipes* forma *pseudobulbosa* Romagn. & Marxm. (see *pseudobulbosa*, below).

cerasi: *Armillaria cerasi* Velen. (1920:282, translation by Pilát, 1948:48) is a species with a honey to lemon yellow, soon smooth pileus and a very long stipe with a broad, persistent, membranaceous, lemon yellow annulus. This description fits *A. mellea* (species D) very well. We requested the loan of the original collections in PR, but they were not available.

---

[4] This species was originally described as *Armillaria cepaestipes*, but Roll-Hansen (1985:26) made the orthographic correction to *A. cepistipes*.

citri: *Agaricus citri* was described by Inzenga (1865:33) as a cespitose agaric with sulphur yellow pileus and a persistent, membranaceous ring, white or sulphur yellow beneath. Singer (1951) studied the type and identified it as *Armillaria mellea* (sensu lato). On the basis of Inzenga's description, *Agaricus citri* is identical with *Armillaria mellea* sensu stricto (species D). Our request for loan of authentic material from PAL was not answered.

congregatus: *Agaricus congregatus* Bolton (1792: nr. 140) was listed by Fries (l.c.) among the synonyms of *Agaricus melleus*. It certainly belongs to that group since the description reads: "...The root produces numerous stems ... and is furnished with numerous fibres ...." The fibres mentioned are rhizomorphs.

We agree with Watling & al. (1982) that *Agaricus congregatus* is probably identical with *Armillaria ostoyae* (species C), although Bolton (l.c.) neither mentioned nor depicted the characteristic dark scales on stipe and annulus. Anyhow, *Agaricus congregatus* Bolton is a superfluous name since the original author referred to "*annularius* Bulliard, 377", reducing his name to a synonym of that species (= *Armillaria mellea* sensu lato).

coryli: *Agaricus melleus* var. *coryli* was described by Briganti (1837:82, pl. 38) as a fungus with a smooth, saffron yellow pileus, a subcylindrical stipe and a persistent, thick, white ring with yellow margin ("... annulo patulo persistente candido, limbo crassiusculo flavo."). We think that this description fits *Armillaria mellea* sensu stricto (species D) very well.

cumulatus: *Agaricus cumulatus* With. is a superfluous name since Withering (1796:164) quoted Bulliard, plate 377 *(A. annularius)* and Bolton, plate 140 *(A. congregatus),* reducing his name to a synonym. Moreover, the identity is unclear. *A. cumulatus* may be either *Armillaria borealis* (species A, but reddish brown pileus unusual), or, more likely, *A. ostoyae* (species C, but dark scales on stipe and annulus not mentioned).

elasticus: *Agaricus elasticus* Bolton is a species of the *Armillaria mellea* group since Bolton (1788:16) described rhizomorphs: "The root ... emitting ... brown fibres, by means whereof, it takes firm hold in the ground; ...." The presence of rhizomorphs, the terrestrial habitat and the bulbous stipe suggest *Armillaria lutea* (species E). However, the pileus is described as "brownish rust, or ferrugineous" and also depicted as very dark. The veil was described as: "... of a tough substance ... and remains on the top of the stem, like a little ruffle, for several days." Also the plate rather suggests a membranaceous veil, as present in *Armillaria ostoyae* (species C). Therefore we regard *Agaricus elasticus* as a nomen dubium.

fuscopallidus: *Agaricus fusco-pallidus* Bolton (1789:136) was described with the pileus "pale dusky brown," with a few small scales at the centre; the veil "... white, of a soft downy substance, and soon vanishes. It originates in a thick soft annulus, which abides on the stem till the decay of the plant"; the base of the stipe "... emits brown fibres, and frequently sustains several plants." This fungus obviously belongs to *Armillaria mellea* agg. *A. cepistipes* (species B) and *A. bulbosa* (species E) are excluded since the annulus is described as thick and persistent. It differs from *A. ostoyae* (species C) in the paler, less scaly pileus and the absence of dark scales on stipe and annulus. On the other hand, *A. borealis* (species A) and *A. mellea* (species D) usually have a yellowish pileus. Our suggestion to Dr. R. Watling (Edinburgh) that *Agaricus fuscopallidus* might be *Armillaria borealis* was rejected by him. He wrote us (in litt., 1984) that he probably collected Bolton's species on the British Isles and that one isolate appeared to be interfertile with *A. mellea* (species D). It is also possible that this name can be used for an as yet unnamed taxon with a greyish pileus, reported from Europe by Kile & Watling (1983) and provisionally called *Armillariella montagnei* Sing. (see there).

granulosa: *Armillaria granulosa* Velen. (1947:57) was described with basidiocarps growing solitary or in small fascicles, with a slighly squamulose stipe and an annulus with many small teeth. The description is much to short to identify this fungus. We were able to study the holotype, preserved in PR. The collection had been studied before by Svrcek, who wrote the name *Cystoderma cinnabarinum* (A. & S.) Fayod on the label [= *C. terrei* (B. & Br.) Harmaja]. We agree with his identification, among other things on the bsais of urticiform cystidia on the lamellae.

inflata: *Armillaria inflata* Velen. (1920:283, translation into Latin by Pilát, 1948:85) is a fungus with a flesh-coloured to reddish brown pileus, darker squamulose at the centre; a white, then flesh-coloured stipe with distinctly inflated base and with a white, tomentose ring, growing solitary on the soil among grass at a forest edge. The colours, shape of the stipe and the habitat suggest *Armillaria bulbosa* (species E). We consider it as a form of that species with an extremely well-developed veil, which is occasionally observed (Marxmüller, 1982:103). We were not able to study the type, if still present in PR. Instead we received a collection made by Velenovsky in Sept. 1936 near Mirosovice (PR). The collection consists of one dried basidiocarp in very bad condition, the pileus being completely covered by glue. On the basis of the habit with a clavate stipe and a squamulose pileus, and the spore size (± 7-9 × 4.5-5 µm, Q = ± 1.6-1.8), this collection is identical with either

A. lutea (species E) or *A. cepistipes* (species B). Details of the pileipellis were not visible, so that exact identification is impossible..

laricinus: *Agaricus laricinus* was described by Bolton (1788:pl. 20) as a fungus growing on the bark of decaying *Larix* trees, with fasciculate stipes, originating from a common, irregular root, supplied with a narrow, cottony veil and with a relatively small pileus, often hardly broader than the stipe, fox-coloured and "clothy" to the touch. In our opinion this taxon might represent an *Armillaria,* but both the description and the plate suggest abnormal, misshaped basidiocarps. We are not able to link it with one of Korhonen's species. It was recombined in *Armillaria* by Saccardo (1887:81).

lutea: *Armillaria lutea* was described by Gillet (1874:83) as a species with ochre yellow, greenish yellow or reddish pileus, 50-70 mm wide, supplied with small, brown scales, less numerous towards the margin, the margin itself more or less appendiculate with yellow flocks. The stipe was described as firm, 80-100 mm long, thickened at the base ("... courbé et renflé à la base ...."), whitish or rose above the ring, concolorous with the pileus and covered with ochre yellow flocks downwards. The ring is yellowish white, fugacious ("... Collier blanc-jaunatre, remontant ...."). It grows solitary or in small groups on old stumps, at the base of trees.

The details of the ring, described by Gillet (l.c.), agree only with species B or species E. The morphological differences between these biological species are subtle and inconstant (see key), but we think that some characteristics strongly favour the latter species: (1) the scales on the pileus are not restricted to the centre of the pileus, (2) the yellow flocks on the stipe are striking, (3) the stipe is thickened at the base but not strongly bulbous. In fact we think that this description matches species E even better than the description of *A. mellea* var. *bulbosa* by Barla (1887: 143), which is the basionym of the current name for species E (see that epithet). Consequently, *Armillaria lutea* Gillet has priority over *A. bulbosa* (Barla) Kile & Watl. Unfortunately no authentic collection of *A. lutea* is present in Gillet's herbarium, deposited in PC (comm. by J. Perreau). We refrain from indication of a neotype since no collection was available that answered the following criteria: collected in France; genetically tested against other species of *Armillaria;* extensive description of fresh carpophores extant.

melleus: *Agaricus melleus* Vahl (in Fl. Dan., 1792:9) is the type of the sanctioned name *Agaricus melleus* Vahl:Fr. (1821:30), and therefore of great nomenclatural importance. Korhonen (1978:37) suggested that this name should be applied to species D, but Marxmüller (1982:94) rightly stated that Vahl's plate fits at least as well species A *(Armillaria borealis)* as species D. Watling & al. (1982) investigated material of species D, collected near Copenhagen (the area where Vahl usually collected) and pointed out that no discrepancy with Vahl's plate exists. Although we feel not entirely convinced

— *A. borealis* is also found in Denmark (Marxmüller & Printz, 1982:9) — we follow this view on behalf of nomenclatural stability and because we have no decisive arguments against it.

A neotype of *Agaricus melleus* was proposed by Watling & al. (1982:281), collected by Knudsen and Watling (19494) near Copenhagen, 10 Oct. 1976, deposited in E.

millus: The original description of *Agaricus millus* by Sowerby (1797:28, pl. 184) contains very limited information on the morphology of the basidiocarps. It is only stated that "... the prickly collar is most likely to afford a specific difference ...." The plate shows fasciculate basidiocarps, which might belong to *Armillaria mellea* agg., but the ring is very curious indeed. It is made up of separated, pointed scales arranged around the apex of the stipe like a star. From the bases of the stipes white mycelial strands go into the soil. No authentic collections of *Agaricus millus* were available in K, LIV, or BM.

Marxmüller (1982, Figs. 3, 4) described and depicted several forms of both *Armillaria lutea* (species E) and *A. cepistipes* (species B) with a more or less star-shaped ring. This type of ring has not been observed in other species. In our opinion it is impossible to identify Sowerby's defective description with one of these species and we even doubt whether it is a species of *Armillaria* at all. Consequently we regard *Agaricus millus* as a nomen dubium. The name was sanctioned by Fries (1821:193). Saccardo (1887:81) combined it in *Armillaria*.

minor: Barla (1887:143; 1888: pl. 21, figs. 3, 4) described and depicted *Armillaria mellea* var. *minor* as a fungus usually growing in small groups, with an umbonate pileus, 30-50 mm wide, yellowish with darker centre, with fibrillose or glabrous margin, a slender, cylindrical stipe, 40-60 × 3-5 mm, reddish with white apex and a thin, white, tomentose ring. In our opinion it is a small form of A. *mellea* (species D).

montagnei: *Armillariella montagnei* Sing. (1956:182, fig. 1) was originally described from Argentine and Chile, but later also reported from Sweden (Singer, 1969). According to the original description the pileus is "olive melleous," at first with very small ochre brown squamules all over; the stipe has some yellow flocks and is supplied with a persistant, thick, membranaceous, white ring with some yellow flocks at the underside, whereas all hyphae are without clamp connections (but absence of clamps from the basidia was not explicitly mentioned). According to Singer (1970) *A. montagnei* differs from *Armillaria mellea* in the not viscid pileus with more olivaceous than yellow pigment and in the smaller spores. However, at that time the species concepts in *A. mellea* agg. were not clear, so that it is not clear to which biological species Singer actually refered. In our opinion the original description of *Armillariella montagnei* perfectly fits in with the

European *Armillaria mellea* s.str. (species D). However, caution is needed before synonymizing a species from South America with an European species. Interfertility tests would be very useful. Our request for loan of the holotype, preserved in LIL, was not answered.

Herink (1973:41) was the first author to make the combination *Armillaria montagnei*, making the combination by Kile & Watling (1983) superfluous. The latter authors assigned *A. montagnei* to a group of species combining a grey pileus and absence of clamps. In the original description by Singer (1956) the colour of the pileus was described quite different, however. In addition Kile & Watling (l.c.) claimed that such a grey species is also found in Europe. We do not know such a fungus, but if it appears to be really distinct from *A. mellea,* the name *A. montagnei* cannot be used in our opinion. *Agaricus fuscopallidus* Bolton may be an alternative (see there).

obscura Gillet: *Armillaria mellea* var. *obscura* has been described by Gillet (1874:84) without a reference to earlier names, consequently as a new taxon. The short diagnosis reads: "... Plus petit. Chapeau brunâtre, couvert d' écailles plus nombreuses et noires ...." In our opinion this description represents *A. ostoyae* (species C), the more so since Gillet (l.c.:83) distinguished also *A. lutea* (species E). No authentic collections of *A. mellea* var. *obscura* are present in Gillet's herbarium (PC, comm. J. Perreau).

obscurus Pers.: *Agaricus obscurus* was described by Persoon (1801:347) as a small fungus with an umbonate, squamulose, fuligineous pileus and olivaceous brown lamellae, occuring in pine forests. Consequently it has nothing to do with *Armillaria,* but in fact was correctly transferred to *Inocybe* by Gillet (1874:515). However, it should be noticed that *Agaricus obscurus* Pers. is a later homonym of *A. obscurus* Schaeff. (see there).

Romagnesi (1970:257) described a species of *Armillaria* under the name "*Armillariella obscura* (Pers. ex Secr.) Romagn." Marxmüller (1982) found that this species was compatible with *Armillaria ostoyae* (species C). In that case the epithet "obscura' should have priority.However, Romagnesi (l.c.) made some errors when he adopted this name. He quoted as basionym "*Agaricus polymyces obscurus,* Pers., Syn. f., p. 271, obs." However, on the indicated page no description of such a fungus is found. "Obs." does not mean here "var. *obscurus,*" but simply "observationes," accompanying the description of *Agaricus polymyces* on page 270. This error can be explained by a reference from Romagnesi (l.c.) in his bibliography to Secrétan (1833), worded: "Myc. Suisse, no. 44, p. 47, *Ag. obscurus* Pers. 1833." However, Secrétan (l.c.) described on that occasion *Agaricus obscurus* Schaeff. non Pers. and only in addition he referred to : "Pers., Syn. f. p. 271, *A. polymices* var. (voyez l'observ. au haut de la page)."

On another occasion, Persoon (1800:30) used the name *Agaricus obscurus* for an *Armillaria* in his comments on Schaeffer's plates. Roll-Hansen (1985:28) supposed that this description validated Schaeffer's name, based on a plate only. However, Schaeffer himself published a description, accompanying his plate of 1762, as early as 1774 (see also below). Finally, Persoon (1797:19) mentioned *Agaricus obscurus* Schaeff. as a synonym (not a variety!) of *A. polymyces* Pers. In conclusion, *Agaricus obscurus* Pers. is a species of *Inocybe* and *A. polymyces* var. *obscurus* Pers. does not exist.

obscurus Schaeff.: The description of *Agaricus obscurus* by Schaeffer (1774:nr. 65) is very short and incomplete: it is an agaric, mostly growing solitary ("plerumque solitarius") with a squamose pileus and a membranaceous, white ring. The accompanying plate (Schaeffer, 1762: pl. 74, figs. 1-8) shows two basidiocarps, joined at the bases, with a pileus covered with distinct scales and a thin ring without scales. The name has been adopted (although with incorrect author citation) by Roll-Hansen (1985:25) and some other mycologists for Korhonen's species C. On the other hand, Watling & al. (1982) suggested that *A. obscurus* Schaeff. may be identical with species E. In our opinion the original description is too incomplete to suggest any evidence that it is a particular biological species and even to be sure that it is an *Armillaria*. The usually solitary occurrence conflicts with *A. ostoyae* (species C) and the membranaceous ring with *A. bulbosa* (species E).

occultans: *Agaricus occultans* Batsch (1783:55) was listed by Fries as a synonym of *A. melleus*. Indeed it is probably an *Armillaria* since the pileus was described as subsquamulose, the presence of a white ring was indicated and a reference was given to *Agaricus obscurus* Schaeff. It is not possible to give a more exact identification. Moreover, in view of the reference to Schaeffer's name it is a superfluous name. No authentic collections of *A. occultans* exist in JE (comm. by G. Hirsch).

ostoyae: Korhonen (1978) already supposed that his species C was identical with *Armillariella ostoyae* Romagn. (1970:260). This was confirmed by Marxmüller (1982) and Risbeth (1982) by means of interfertility tests. Herink (1973:42) was the first to recombine this name in *Armillaria*. It is remarkable that we were not able to find an earlier appropriate name for this widespread, rather well characterized species. An older name may still be hidden in older literature. The holotype is deposited in the herbarium of Romagnesi (nr. 69.220 (PC)).

pistillaris: *Agaricus pistillaris* Batsch was listed by Fries (1821:30) among the synonyms of *A. melleus*. The description by Batsch (1783:55) is very short and incomplete and mentions neither scales on the pileus, nor an annulate stipe. Probably it is not an *Armillaria* at all. No authentic collections of *Agaricus pistillaris* exist in JE (comm. by G. Hirsch).

polymyces: The description of *Agaricus polymyces* by Persoon (1797:19) is short and covers all species of *Armillaria mellea* agg. Persoon apparently intended to do so since he listed a number of synonyms, such as *Agaricus obscurus* Schaeff., *A. melleus* Vahl in Fl. Dan., *A. annularius* Bull., *A. congregatus* Bolton and *A. fusco-pallidus* Bolton. Moreover, these citations reduce *A. polymyces* to a superfluous name.

Singer & Clémençon (1972:311) adopted this epithet for a fungus obviously identical with *Armillaria ostoyae* (species C).

praecox: *Armillaria praecox* Velen. (1920:282, translation by Pilát, 1948:85) is a fungus with small basidiocarps, fruiting already in June and July and absent in autumn. The fruiting periodicity immediately reminds one of *A. borealis* (species A), which is the only species of *Armillaria* regularly to be found in summer (Marxmüller, 1982). The other main characteristics described by Velenovsky (l.c.) are: pileus pale pinkish when moist, with scattered dark red-brown scales when young, then smooth with blackening scales only at the centre; stipe with white, tomentose, rimose ring, under the ring yellow squamulose; base of stipe suddenly enlarged into a thick, yellow tomentose bulb. Some important differences with *A. borealis* are the bulbous stipe and the pink pileus, which is usually ochraceous in that species. These characters are in better agreement with *A. lutea* sensu lato (species B and E). Singer (1977) redescribed *A. praecox* (as *Armillariella)* on the basis of fresh collections, made near Prague in July. We agree with Marxmüller (1982:121) that his description suggests *Armillaria borealis* (species A) indeed, but it deviates in important details from Velenovsky's diagnosis. For the time being we consider *Armillaria praecox* Velen. as a nomen dubium, as did Marxmüller (l.c.). A study of possible authentic collections may lead to a different conclusion, although the distinctions in this group are mainly based on macroscopic characters. We were not able to receive collections from Prague on loan.

pseudobulbosa: *Armillaria cepistipes* Velen. forma *pseudobulbosa* Romagn. & Marxm. (1983:314) was described in order to create a formal name for the great majority of collections of *A. cepistipes* with a habit strongly deviating from the type (see that epithet). It is interesting to note that on the basis of the morphology of the basidiocarps we would be inclined to raise this form to the rank of species. Since in *Armillaria* a genetic species concept is widely accepted, and since cultures of the two forms appear to be interfertile (Romagnesi & Marxmüller, 1983), we have abondoned this intention. The holotype of *A. cepistipes* forma *pseudobulbosa* was indicated by Romagnesi & Marxmüller (1983:314) as Marxmüller 8104 and is deposited in M.

putridus: *Agaricus putridus* Scop. (1772:420) may be a species of *Armillaria* in view of the annulate, fasciculate, bulbose stipes, but the description is too vague to be even sure of that.

saviczii: *Armillaria saviczii* was described by Singer (1938:6). A more recent description was published by the same author (1956:178). The pileus is said to be "apparently brownish when fresh ... apparently smooth ... 7-10 mm broad ...." The stipe is "... with white belt-like annulus at the apex, equal, 12-16 × 1-1.5 mm." Black rhizomorphs are present. It was collected on a rotten trunk in a *Picea* wood in July. Our request for loan of the holotype, preserved in LE, was not answered.

According to Romagnesi & Marxmüller (1983) *A. saviczii* may be a synonym of *A. cepistipes* forma *pseudobulbosa* (species B) in view of the small, pale basidiocarps. However, important differences with *A. cepistipes* are the extremely small basidiocarps, the smooth pileus and the equal stipe with a large ring. In our opinion *A. saviczii* may very well not fit into one of Korhonen's species, if belonging to *A. mellea* agg. at all.

stipitis: The description of *Agaricus stipitis* by Withering (1796:191) read "... stem pale brown with a buffy tinge, thicker and bulbous at the base : ring white, permanent ...." He distinguished six varieties: var. 1. *A. fuscopallidus,* var. 2. *A. melleus* and *A. obscurus,* var. 4. *A. obscurus,* var. 5. *A. elasticus,* and vars. 3 and 6 unnamed. In our opinion Withering's description is too incomplete for identification with one of Korhonen's species, and the author apparently intended to include the entire *Armillaria mellea* complex, and is a superfluous name. Watling & al. (1982) suggested that *Agaricus stipitis* Sow. (1797) may represent *Armillaria bulbosa* (species E), but Sowerby's name is based on *Agaricus stipitis* With. and therefore it is also identical with *Armillaria mellea* agg.

viridiflava: The description and plate of *Armillaria mellea* var. *viridiflava* by Barla (1887:143, pl. 11, fig. 2) strongly suggests *A. mellea* sensu stricto (species D): the pileus is greenish with small scales, the stipe pale yellow with a tomentose, lemon yellow ring. Only the strongly squamulose pileus, depicted in the plate, is somewhat aberrant.

vitis: The description of *Agaricus melleus* var. *vitis* Brig. (1837:47, pl. 21, fig. 1) is very short and the plate is not characteristic. In our opinion it can only be assessed that it belongs to *Armillaria mellea* agg.

CONCLUSIONS

We have studied 36 names of taxa, possibly belonging to *Armillaria mellea* agg. Since the morphological differences between the basidiocarps of Korhonen's genetic species A-E are subtle, only a few older names could be identified with one of these species. The names which we regard as correct are listed below, together with the more important synonyms. We included some names with a ?, which we believe to be doubtful, but which may be acceptable for other mycologists and certainly deserve further attention.

Our search for ancient *Armillaria* names has probably not been exhaustive. Additional name changes may be necessary in future. It is remarkable in particular that no older name is available for the widespread species C than *Armillariella ostoyae* Romagn. (1970).

Species A.

Correct name: *Armillaria borealis* Marxm. & Korh. in Marxmüller, Bull. trimest. Soc. mycol. Fr. 98:122. 1982.

Synonym: *? Armillaria praecox* Velen., Ceské Houby: 282. 1920.

Species B.

Correct name: *Armillaria cepistipes* Velen., Ceské houby: 283. 1920.

Synonym: *Armillaria cepistipes* forma *pseudobulbosa* Romagn. & Marxm., in Bull. trimest. Soc. mycol. Fr. 99:314. 1983.

Species C.

Correct name: *Armillaria ostoyae* (Romagn.) Herink in Hasek, in Symp. václ. obecné *Armillaria mellea* (Vahl ex Fr.) Kumm., p.42. 1973.

Basionym: *Armillariella ostoyae* Romagn., in Bull. trimest. Soc. mycol. Fr. 86:260. 1970.

Synonyms: *Agaricus congregatus* Bolton, Hist. Fung., app.: nr.140. 1792 ('1791') [nomen superfl.].
Armillaria mellea var. *obscura* Gillet, Hyménomycètes: 84. 1874.

Misapplied names:
Armillariella obscura sensu Romagn., in Bull. trimest Soc. mycol. Fr. 86:257. 1970; sensu Marxmüller & Printz, in Svampe 5:3. 1982; sensu auct. eur.
Armillaria obscura sensu Marxmüller, in Bull. Soc. trimest. Soc. mycol.Fr. 98:118. 1982; sensu Herink in Hasek, in Symp. václ. obecné *Armillaria mellea* (Vahl ex Fr.) Kumm.:42. 1973; sensu Roll-Hansen, Eur. J. Forest Pathol. 15:28. 1985; sensu auct. eur.
Armillariella polymyces sensu Sing. & Clémencon, Nova Hedw. 23:311. 1972; sensu auct. eur.

Species D.

Correct name: *Armillaria mellea* (Vahl:Fr.) Kumm., Führ. Pilzk.: 25. 1871.

Basionym: *Agaricus melleus* Vahl:Fr., Syst. mycol. 1:30. 1821.

Synonyms: *Agaricus melleus* Vahl in Fl. Dan. 6(17):9, pl. 1013. 1792.
Armillariella mellea (Vahl:Fr.) P. Karst., Acta Soc. Fauna Flora fenn. 2:4. 1881.
Clitocybe mellea (Vahl: Fr.) Ricken, Blätterp.: 362. 1915.
Agaricus annularius luteus var. C. Secr., Monogr. Suisse: 50. 1833 [nomen inval.].
Agaricus melleus var. *coryli* Brig., Hist. Fung. Neapol.: 82. 1837.
Agaricus citri Inzenga, Funghi Siciliani, centuria prima: 33, pl. 3. 1865.
Armillaria mellea var. *minor* Barla, Bull. Soc. mycol. Fr. 3:143. 1887.
? *Armillaria mellea* var. *viridiflava* Barla, Bull. Soc. mycol. Fr. 3:143. 1887.
Armillaria cerasi Velen., Ceské houby: 282. 1920.

? *Armillariella montagnei* Sing., Lloydia 19:182. 1956.
Armillaria montagnei (Sing.) Herink in Hasek, in Symp. václ. obecné *Armillaria mellea* (Vahl ex Fr.) Kumm., p.41.1973.

Species E.

Correct name: *Armillaria lutea* Gillet, Hyménomycètes: 83. 1874.

Synonyms: *Armillaria mellea* var. *bulbosa* Barla, Bull. Soc. mycol. Fr. 3:143. 1887.
Armillariella bulbosa (Barla) Romagn., Bull. trimest. Soc. mycol. Fr. 89:199. 1973.
Armillaria bulbosa (Barla) Kile & Watl., Trans. Br. mycol. Soc. 81: 135. 1983.
Armillaria inflata Velen., Ceské Houby: 283. 1920.

ACKNOWLEDGEMENTS

We are much indebted to Drs. R. P. Korf (Ithaca), Th. W. Kuyper (Wijster) and R. Watling (Edinburgh) for their assistence in solving some nomenclatural problems and their critical reading of the manuscript. Many thanks are also due to Dr. K. Korhonen (Vantaa, Finland) and Mrs. H. Marxmüller (München) for valuable correspondence, the gift of important collections and the loan of colour slides. We gratefully acknowledge the help of the directors and curators of the herbaria BM, JE, K, LIV, M, and PC for the loan of collections or information on type collections.

REFERENCES

ANTONIN, V. 1986. Studies in annulate species of the genus *Armillaria* — I. Study of type-specimens of *Armillaria cepaestipes* Velenovsky. *Ceská Mykologie* 40:38-40.
BARLA, J.-B. 1887. Liste des champignons. *Bull. Soc. mycol. Fr.* 3:140-144.
BARLA, J.-B. 1888. *Flore mycologique illustrée. Les champignons des Alpes-Maritimes*. Nice.
BAS, C. 1983. Notulae ad floram agaricinam neerlandicam. Introduction. *Persoonia* 12:29-30.
BATSCH, A.J.G.C. 1783. *Elenchus fungorum*. Halae Magdeburgicae.
BOLTON, J. 1788. *An history of fungesses growing about Halifax*. Vol. 1. Edinburgh.
BOLTON, J. 1789. *Idem*. Vol. 3. Stannory.
BOLTON, J. 1792. *An appendix or supplement to the History of fungusses growing about Halifax*. Stannory.
BRIGANTI, V. 1837. *Historia fungorum regni Neapolitani*. Specimen tertium. Napoli.
BULLIARD, P. 1788. *Histoire de champignons de la France*. Paris.
FRIES, E.M. 1821. *Systema mycologicum*. Vol. 1. Lundae.
GILLET, C.-C. 1874. *Les Hyménomycètes*. Alençon.
HERINK, J. 1973. Taxonomy of Armillaria mellea. In: J. Hasek (ed.), *Sympozium o václavec obecné* — Armillaria mellea *(Vahl ex Fr.) Kumm.:* 21-48. Sbornik referátu.
INZENGA, G. 1865. *Funghi Siciliani*. Centuria prima. Palermo.
KILE, G.A. & WATLING, R. 1983. *Armillaria* species from South-Eastern Australia. *Trans. Br. mycol. Soc.* 81:129-140.
KORHONEN, K. 1978. Interfertility and clonal size in the *Armillariella mellea* complex. *Karstenia* 18:31-42.
KUMMER, P. 1871. *Der Führer in die Pilzkunde*. Zerbst.

MARXMÜLLER, H. 1982. Étude morphologique des *Armillaria* ss. str. à anneau. *Bull. trimest. Soc. mycol. Fr.* 98:87-124.
MARXMÜLLER, H. & PRINTZ, P. 1982. Honningsvampe. *Svampe* 5: 1-10, 59-60.
PERSOON, C.H. 1797. *Tentamen dispositionis methodica fungorum.* Lipsiae.
PERSOON, C.H. 1800. *Commentarius D. Jac. Christ. Schaefferi fungorum indigenorum icones pictas.* Erlangae.
PERSOON, C.H. 1801. *Synopsis methodica fungorum.* Göttingen.
PETERSEN, R.H. 1977. An annotated index for Bulliard's "Histoire des champignons." *Mycotaxon* 6:127-166.
PILÁT, A. 1948. Velenovskyi species novi Basidiomycetum in linguam latinum traduxit. *Opera bot. Cechica* 6. Praga.
RISHBETH, J. 1982. Species of *Armillaria* in southern England. *Pl. Pathol.* 31:9-17.
ROLL-HANSEN, F. 1985. The *Armillaria* species in Europe. *Eur. J. For. Path.* 15:22-31.
ROMAGNESI, H. 1970. Observations sur les *Armillariella* (I). *Bull. trimest. Soc. mycol. Fr.* 86: 257-265.
ROMAGNESI, H. 1973. *Idem* (II). *Bull. trimest. Soc. mycol. Fr.* 89:195-206.
ROMAGNESI, H. & MARXMÜLLER, H. 1983. Étude complémentaire sur les armillaires annelées. *Bull. trimest. Soc. mycol. Fr.* 99:301-324.
SACCARDO, P.A. 1887-1931. *Sylloge fungorum.* Vols. 5-25. Padua.
SCHAEFFER, J.C. 1762. *Fungorum qui in Bavaria et Palatinatu circa Ratisbonam nascuntur.* Vol. 1. Ed. 1. Regensburg.
SCHAEFFER, J.C. 1774. *Idem.* Vol. 4. Ed. 1. Regensburg.
SCOPOLI. J.A. 1772. *Flora carniolica.* Vol. 2. Ed. 3. Vienna.
SECRETAN, L. 1833. *Mycographie Suisse.* Genève.
SINGER, R. 1938. De nonnullis Basidiomycetibus. *Not. syst. Sect. crypt. Inst. bot. Acad. scient. SSSR* 4(10-11): 4-18.
SINGER, R. 1951. Type studies on basidiomycetes. V. *Sydowia* 5:445-475.
SINGER, R. 1956. The *Armillaria mellea* group. *Lloydia* 19:176-187.
SINGER, R. 1969. Mycoflora australis. *Beih. Nova Hedw.* 29: 1-405.
SINGER, R. 1970. *Omphalina.* In: *Flora neotropica Monograph* 3:1-16.
SINGER, R. & CLÉMENÇON, H. 1972. Notes on some leucosporous and rhodosporous Europan agarics. *Nova Hedw.* 23:305-352.
SOWERBY, J. 1797. *Coloured figures of English fungi.* Vol. 1. London.
TERMORSHUIZEN, A. 1984. Taxonomie en oecologie van de geringde Europese Honingzwammen (*Armillaria mellea* (Vahl: Fr.) Kummer sensu lato). *Report Agricultural University Wageningen,* 103 pp. (photo-offset).
TERMORSHUIZEN, A. 1985. De Europese Honigzwammen — enige aspecten van taxonomie en oecologie. *Coolia* 28: 64-78.
TERMORSHUIZEN, A. 1987. Field ecology and geographical distribution of species of *Armillaria mellea* agg. in the Netherlands (in prep.).
VAHL, M. 1790. *Flora danica.* Vol. VI(17). København.
VELENOVSKY, J. 1920. *Ceské houby.* Vol. 1. Praga.
VELENOVSKY, J. 1947. *Ceské houby.* Vol. 2. Praga.
VOSS, E.G. & AL. 1983. International code of botanical nomenclature. *Regnum vegetabile.* Vol. 111. Utrecht.
WATLING, R., KILE, G.A. & GREGORY, N.M. 1982. The genus *Armillaria* — nomenclature, typification, the identity of *Armillaria mellea* and species differentiation. *Trans. Br. mycol. Soc.* 78:271-285.
WITHERING, W. 1796. *An arrangement of British plants.* Vol. IV. Ed. 3. Birmingham.

MYCOTAXON

Vol. XXX, pp. 117-125 October-December 1987

NOTES ON COELOMYCETES. II. CONCERNING THE FUSICOCCUM ANAMORPH OF BOTRYOSPHAERIA RIBIS.

GARETH MORGAN-JONES

Department of Plant Pathology, College of Agriculture and Alabama
Agricultural Experiment Station, Auburn University, Auburn, Alabama 36849

and

J.F. WHITE, JR.*

Department of Botany, The Ohio State University,
Columbus, Ohio 43210

ABSTRACT

The *Fusicoccum* anamorph of *Botryosphaeria ribis* Grossenb. & Duggar is described and illustrated from collections made on several hosts in the southeastern United States and from pure culture.

INTRODUCTION

An anamorphic fungus belonging to the genus *Fusicoccum* Cda has been collected a number of times in the southeastern United States on various hosts and isolated in pure culture. It appears to be relatively common in this region, occurring on at least several different host plant genera as a weak pathogen or secondary invader of necrotic tissue. An attempt to identify and apply a binomial to it has led to the realization that the taxonomy of the genus *Fusicoccum* is, at present, in a rather chaotic state. It contains over a hundred taxa but no critical revisionary studies have been conducted. As a result, species concepts are poorly defined and although a plethora of names are extant in the literature, it is by no means easy to apply binomials with confidence. Sutton (1980) has pointed out that even the status of the name *Fusicoccum* and its type species, *F. aesculi* Cda, has, in the past, been a source of confusion. Type material of the type species does not appear ever to have been reexamined but Sutton (1980) published a description and illustration of the taxon based on a specimen from the Saccardo herbarium. Saccardo (1880) provided an account, and later (Saccardo, 1886) an illustration, of it based on material collected at Padua. Although Saccardo

*Part of the work on which this paper is based was conducted while the junior author was a M.S. student at Auburn University.

Alabama Agricultural Experiment Station Journal Series No. 18-871276

(1884), in another publication, mentioned Czechoslovakian material, it is uncertain whether or not he ever examined a Corda specimen. Until the type specimen is studied, some doubt must therefore remain concerning Saccardo's interpretation of the original use of the name *F. aesculi*. The similarity between the illustrations by Corda (1829) and Saccardo (1886) suggests, however, that the latter author had the right fungus. Höhnel (1916) described *Fusicoccum* Cda, based on *F. aesculi*, as being melanconiaceous and distinguished it from *Fusicoccum* Sacc. It is unclear what Höhnel meant by the latter since Saccardo (1884, 1895), Saccardo and Sydow (1889, 1902), and Saccardo and Trotter (1913) invariably cited the generic name as *Fusicoccum* Cda. Petrak (1922) considered the fungus called *F. aesculi* by Saccardo to be the anamorph of *Botryosphaeria dothidea* (Moug.) Ces. & de Not. [as *Botryosphaeria berengeriana* de Not.] but classified it in *Dothiorella* Sacc. Petrak assumed that Saccardo had misapplied the name *F. aesculi* and, because of this, effectively established a new binomial, *D. aesculi* Petrak, for it rather than achieving a transfer. If the use of the name *F. aesculi* by Saccardo is eventually found to have been correct, *D. aesculi* Petrak becomes a synonym of it. Petrak (1921) previously had added to the confusion surrounding application of the name *F. aesculi* Cda when he determined that it and *Septomyxa aesculi* Sacc., the name of the anamorph of *Diaporthe aesculi* (Fckl) Höhnel [≡ *Cryptodiaporthe aesculi* (Fckl) Petrak], represented the same fungus. Because of this opinion he proposed the name *Septomyxa aesculi* (Cda) Petrak [basionym: *Fusicoccum aesculi* Cda], thereby creating an illegitimate homonym of *S. aesculi* Sacc., for what was incorrectly assumed to be one fungus. Had the two, in reality, been conspecific, *Fusicoccum* should, in any case, have been recognized as having date priority over *Septomyxa* Sacc. *Septomyxa aesculi* Sacc. was transferred to *Diplodina* Westd. [as *D. aesculi* (Sacc.) Sutton] by Sutton (1980) and *Septomyxa* is therefore considered a synonym of that genus.

Despite the unsatisfactory state of our knowledge of fungi given the name *Fusicoccum*, its use for anamorphs of at least some species of *Botryosphaeria* Ces. & de Not, including *B. dothidea* and *B. ribis* Grossenb. & Duggar, seems justified. The collections made in Alabama, which form the subject of this paper, are thought to be of the *Fusicoccum* anamorph of *B. ribis* [B.C. Sutton, in lit., who examined an isolate sent to him (IMI 281025)] on the basis of a wide host range and presence of both macroconidia and microconidia. Although this anamorph probably has many names in the literature, at present it is not possible to apply a valid binomial to it with confidence. Unraveling of anamorph names, involving examination of types and consideration of date priority, will be necessary before the correct name for it can be determined.

Grossenbacher and Duggar (1911) described a shoot blight of currants (*Ribes* spp.) in New York and named the causal ascomycete *Botryosphaeria ribis*. In addition to the teleomorph, they reported the presence of an associated anamorph with structurally variable conidiomata. The fungus was reported to infect young shoots in mid-summer at about the time elongation growth ceases and to sporulate shortly thereafter and on older canes during the following season. A pycnidial conidioma, referred to as a *Macrophoma*-form, was said to be the first to develop on withering tips of young shoots, followed by a stromatic *Dothiorella*-form and the teleomorph on dead canes in the succeeding year. Morphologically similar, fusoid conidia were reported to be produced in both types of anamorphic structures. In addition, a microconidial form was observed but the authors doubted that it belonged to *B. ribis*. Two differing strains of the fungus were found to exist: one chromogenic (forming a purple-pink coloration

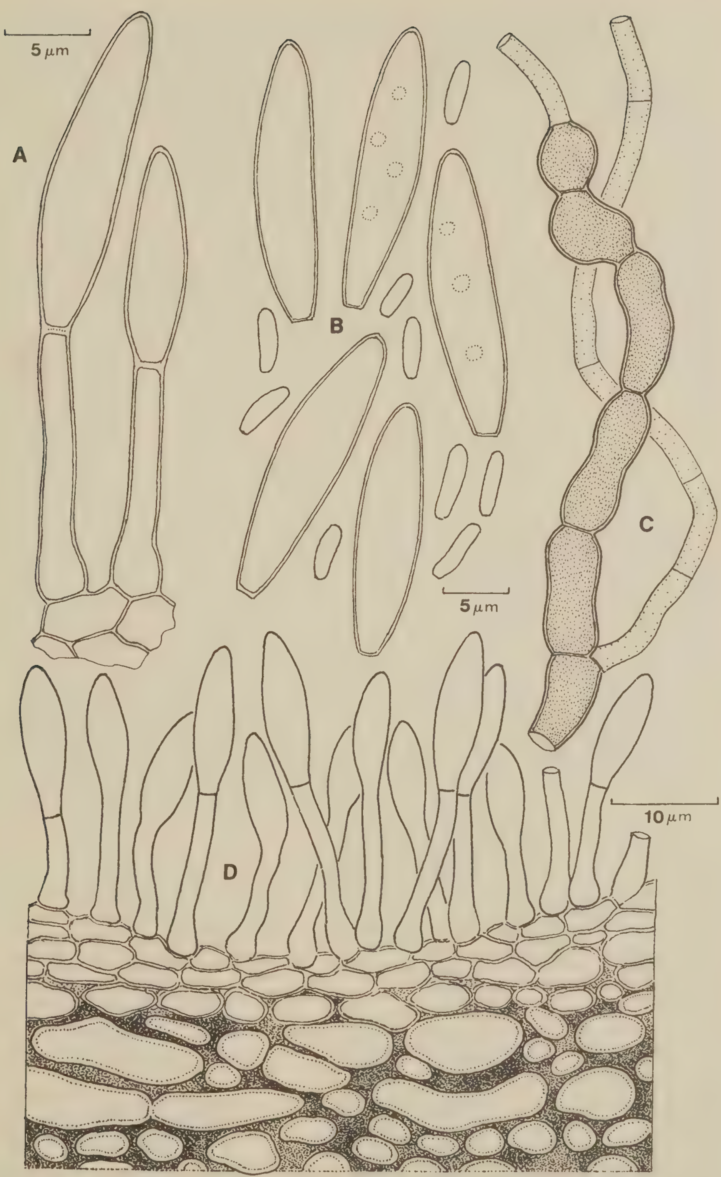

5 µm
A
B
5 µm
C
10 µm
D

FIGURE 1. A, conidiogenous cells and developing conidia; B, macro and microconidia; C, swollen hyphal elements; D, portion of conidiomal wall in section.

on starch paste) and strongly parasitic, the other non-chromogenic and a saprophyte. The latter was referred to as *B. ribis* forma *achromogena*. Stevens and Jenkins (1924) encountered what they considered to be the same fungus on horsechestnut (*Aesculus hippocastanum* L.) and certain varieties of rose. In the latter, stem canker was found to be produced. Isolates from fruits of chestnut were shown to be chromogenic and, in inoculation experiments, were demonstrated to be capable of infecting currants. Later the same year Shear *et al.* (1924) confirmed the observations of Grossenbacher and Duggar and documented the presence of microconidia (referred to as micropycnospores) intermixed with normal conidia or produced in separate locules. They noted the fungus to occur on apple in North America but in its non-chromogenic form. Parasitic strains derived from currant were referred to as *B. ribis chromogena*. The anamorph again was alluded to as *Dothiorella*, in this instance because it was considered to be congeneric with *D. gregaria* Sacc. Shear *et al.* (1924) also noted that it was not *Dothiorella ribis* (Fckl) Sacc. [*Dothiorella* Sacc., type species *D. pyrenophora* Sacc., may be an earlier name for *Botryodiplodia* (Sacc.) Sacc. (Sutton, 1977) but type studies are necessary before this can be confirmed.] *Botryosphaeria mali* Putterill, the causal organism of apple tree canker in South Africa (Putterill, 1919), was considered by Shear *et al.* to be the same as *B. ribis*.

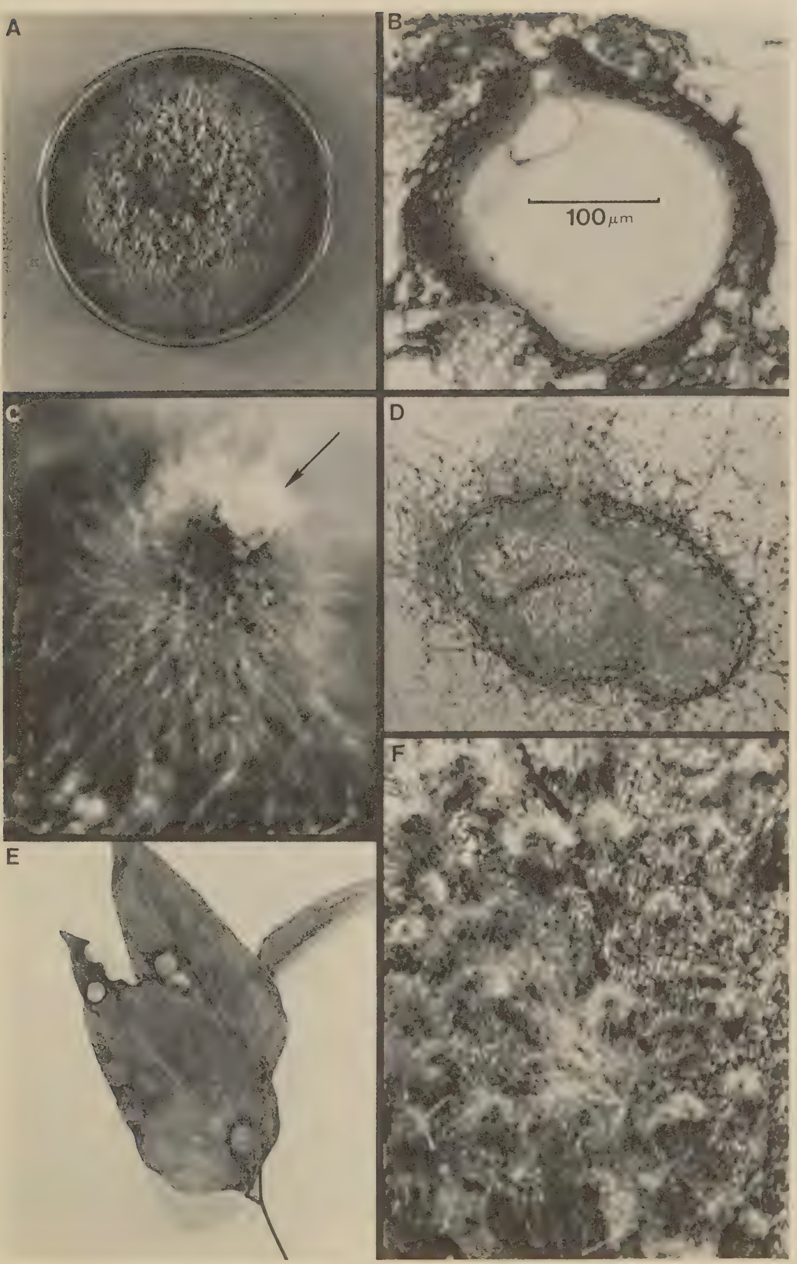
According to Arx and Müller (1954), both *B. mali* and *B. ribis* are synonyms of *B. dothidea*. If this is the case, *Fusicoccum aesculi*, although not known at present to produce a microconidial state, may be the correct name for the anamorph reported upon in this paper. Since *F. aesculi* has chestnut as its host and Stevens and Jenkins (1924) were able to infect currants with isolates from *Aesculus hippocastanum*, it might well be that only one plurivorous species is involved.

The cane blight fungus of *Ribes* spp. in North America is well known under its original teleomorphic name and its anamorph is referred to, advisedly, as the *Fusicoccum* state of *B. ribis* herein. As a contribution to knowledge of *Fusicoccum* and to a better understanding of species characteristics within it, description and illustration of this anamorph *in vitro* are provided, together with comments on its morphology *in vivo*.

MATERIALS AND METHODS

The fungus was isolated from conidial masses exuding from superficial conidiomata on leaves of *Smilax laurifolia* (Auburn, Lee Co., Alabama collection). Colony characteristics and radial growth rates were determined on potato dextrose agar and malt extract agar incubated at three temperatures (20, 25 and 30C) in the dark. Five replicate plates, each inoculated with a single 5-mm-diameter agar disk cut from the edge of an actively growing 14-day-old colony on PDA, per treatment were used. Host tissue bearing conidiomata and conidiomata on agar were fixed in FAA, dehydrated into absolute ethanol and embedded in LR White® (hard) acrylic embedding medium. Vertical sections

PLATE 1. A, three-week-old colony on PDA; B, V.S. pycnidium-like conidioma on *Smilax* leaf; C, conidioma on *Smilax* leaf with exuding conidial mass (indicated by arrow); D, V.S. conidioma on cellulose agar; E, conidiomata in leaf-miner lesions. F, superficial conidiomata on *Smilax* leaf following incubation in a moist chamber.


A
B
100 µm
C
D
E
F

were obtained using a Sorvall® MT-2 "Porter Blum" ultramicrotome and stained in toluidine blue before mounting.

TAXONOMIC PART

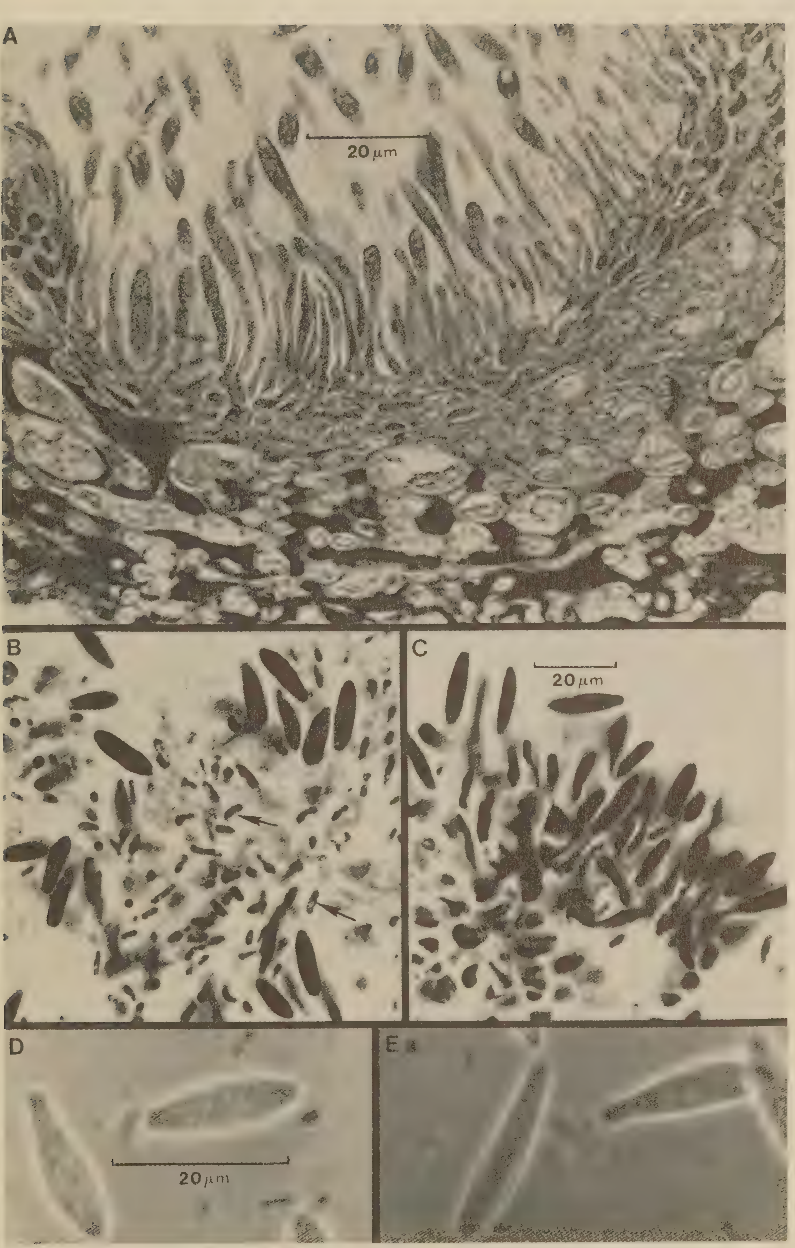
Fusicoccum state of *Botryosphaeria ribis* Grossenb. & Duggar, *N.Y. Agric. Exp. Stn Geneva Tech. Bull.* 18: 183, 1911 (Plates 1 and 2, Figure 1).

Colonies on potato dextrose agar [Difco] (Plate 1, A), pale grayish buff, lanose to floccose, with scattered whitish flocci, attaining a diameter of 20 mm at 20C after 4 days, 41 mm at 25C and 43 mm at 30C, becoming dark greenish-gray to greenish-black with age; reverse at first buff, later becoming blackish. Colonies on malt extract agar [Difco] with sparse aerial mycelium, felted, buff, attaining a diameter of 16 mm at 20C after 4 days, 30 mm at 25C and 33 mm at 30C. Pycnidia produced sparsely to moderately after 21 days on both PDA and MEA. Colonies on cellulose agar (Morgan-Jones and White, 1983) with very little aerial mycelium, producing pycnidia abundantly after 21 days. Mycelium composed of septate, branched, subhyaline to pale brown, smooth, 2-8 µm wide hyphae. In older cultures, cells of some hyphae become slightly inflated and mid-brown in color producing a chain of chlamydospore-like elements. Conidiomata superficial or partly immersed in agar, pycnidium-like or, more often, eustromatic and multilocular, subglobose or irregular in shape; venter of solitary conidiomata sometimes partly subdivided by mounds or partitions of wall cells (Plate 1,D). On PDA conidiomata covered with dense, appendage-like hyphae giving the surface a somewhat velvety appearance, where solitary and pycnidium-like with one or two indistinct ostioles and 300-500 µm in diameter, where stromatic up to 2 mm in diameter. Conidiomatal wall of various thickness, 30-50 µm wide, composed of elongate, ellipsoidal and subspherical cells; with an inner zone of tightly packed, comparatively small, thin-walled, flattened, subhyaline cells and an outer zone of larger, up to 16 µm in diameter, loosely organized, thicker-walled, pale brown cells between which irregular deposits of dark brown, extracellular material is frequently evident (Plate 2, A). Exuded conidial mass whitish. Conidiophores produced from cells lining the conidiomatal venter, sometimes branched, straight or somewhat flexuose, often slightly swollen at the base, up to 22 µm in length, 1.5-2.5 µm wide,. Conidiogenous cells holoblastic, monoblastic, discrete, determinate, smooth, hyaline, cylindrical. Macroconidia solitary, fusiform or somewhat clavate, hyaline, frequently guttulate, aseptate, smooth, straight, obtuse at the apex, truncate at the base, detached schizolytically, 14-23 X 3-4.5 µm. Microconidia oblong or narrowly ellipsoid or cylindrical, rod-like, aseptate, smooth, hyaline, 3-7 X 1-1.5 µm.

In nature, conidiomata superficial or partly or wholly immersed, depending upon fungal strain and host tissue type. On leaves frequently superficial in lesions caused by other organisms and pycnidium-like. Parasitic strains in stems and twigs generally immersed and eustromatic.

Plurivorous; North America.

PLATE 2. A, V.S. conidiomal wall, conidiogenous cells and conidia (from culture on cellulose agar); B, macro and microconidia (indicated by arrows) stained with aniline blue; C, squash of conidiogenous cells and macroconidia; D & E, macroconidia.


A
20 μm
B
C
20 μm
D
20 μm
E

Collections examined: on *Smilax laurifolia* L., Auburn, Lee Co., Alabama, June 1, 1981, J.F. White, AUA (isolate IMI 281025); on stems of *Rhododendron* sp., Auburn, Lee Co., Alabama, September 9, 1982, A.K. Hagan, AUA; isolated from seedlings of *Alnus glutinosa* (L.) Gaertn., Gainesville, Florida, December 1982, G.M. Blakeslee, AUA.

DISCUSSION

It is evident from the observations made during the course of this study, and from the literature (Grossenbacher and Duggar, 1911; Shear *et al*., 1924), that conidiomata of *B. ribis* can range from being pycnidium-like to quite complex eustromatic structures. Where pycnidial in form, the conidiomata often are partly or entirely superficial on host substrates. On young canes of *Ribes*, however, Grossenbacher and Duggar (1911) found entirely immersed pycnidium-like conidiomata. Pycnidium-like units whether solitary or in clusters were reported to be 175-250 um in diameter. In the case of the collection on *Smilax laurifolia* made by one of us, the fungus was predominantly localized in lesions produced by a dipterous leaf miner. In this circumstance, pycnidium-like conidiomata were produced either immersed in host tissue or, when incubated in a moist chamber, superficially (Plate 1, B). Those produced on the leaf surface were invariably densely covered with appendage-like hyphae (Plate 1, C & F). When occurring on woody stems, conidiomata are mostly subperidermal in position as illustrated by Sutton (1980) for *F. aesculi*. Grossenbacher and Duggar (1911) gave stromatal diameter as 0.5-4 mm, mostly 2 mm. Stromata were said by Shear *et al*. (1924) to vary in size depending on bark thickness and to measure 1 X 2-3 mm on small canes of currant to 3-3.5 X 5-8 mm near the base of older canes. Where the stromata are well developed and fully mature, pseudothecia may be found in nature interspersed with the anamorphic state, usually at the periphery of the fructification giving it a botryose appearence. On some agar media, large stromata which remain sterile are frequently produced. Some difficulty has , in fact, been experienced in the past in inducing conidiation *in vitro*. Grossenbacher and Duggar (1911), for example, failed to obtain conidia in culture but Shear *et al*. (1924) reported being successful in this regard. In this study, invariably fertile eustromatic conidiomata were produced on cellulose agar (Plate 1, D).

Small variation in conidial dimensions apparently occurs in different circumstances. Grossenbacher and Duggar (1911) reported conidia from their so-called *Macrophoma*-form (pycnidium-like conidiomata) to be 16-25 X 4.5-7.5 µm in size, whereas those produced in eustromatic conidiomata (their *Dothiorella*-type) were 18-31 X 4.5-8 µm. Putterill (1919) reported his *B. mali* to have conidia measuring 32.4 X 4.8 µm. It is interesting to note in this connection that Sutton (1980) gave conidial dimensions of the Saccardo material of *F. aesculi* as 18-25 X 4-4.5 µm, again raising the question of whether there is any difference between it and the anamorph of *B. ribis* other than lack of microconidia. He described the conidiogenous cells of *F. aesculi* as being sparingly septate and sometimes branched at the base. This characteristic is not, however, present in the material of the *B. ribis* anamorph examined by us. Shear *et al*. (1924) reported their so-called micropycnospores to be 2-3 µm long, rather shorter than those observed in this study.

ACKNOWLEGMENTS

We thank Dr. B.C. Sutton, CAB International Mycological Institute, Kew, Surrey, United Kingdom, for examining the isolate submitted to him and conveying his opinion as to its identity. The manuscript was reviewed by Dr. Dean A. Glawe, Department of Plant Pathology, University of Illinois, to whom we are grateful.

LITERATURE CITED

ARX, J.A. VON and E. MÜLLER. 1954. Die Gattungen der amerosporen Pyrenomyceten. *Beitr. Krypfl. Schw.* 11: 1-434.
CORDA, A.C.I. 1829. Strum's *Deutschlands Flora* 3: 105-136.
GROSSENBACHER, J.G. and B.M. DUGGAR. 1911. A contribution to the life-history, parasitism and biology of *Botryosphaeria ribis. N.Y. Agric. Exp. Stn Geneva Tech. Bull.* 18 114-188.
HÖHNEL, F. VON. 1916. Mykologisches. XXIV. *Öst. bot. Z.* 66: 94-112.
MORGAN-JONES, G. and J.F. WHITE, JR. 1983. Studies in the genus *Phoma*. I. *Phoma americana* sp. nov. *Mycotaxon* 16: 403-413.
PETRAK, F. 1921. Mykologische Notizen. II *Ann. mycol* 19: 17-128.
PETRAK, F. 1922. Beiträge zur Kenntnis der Pilzflora der südlichen Alpenländer und Norditaliens. *Ann. mycol.* 20: 126-159.
PUTTERILL, V.A. 1919. A new apple tree canker. *S. Afr. Jour. Sci.* 16: 258-272.
SACCARDO, P.A. 1880. Fungi gallici. ser. II. *Michelia* 2: 38-135.
SACCARDO, P.A. 1884. *Syll. fung.* 3: 1-860.
SACCARDO, P.A. 1886. Fungi Italici Sphaeropsideae no. 1459.
SACCARDO, P.A. 1895. *Syll. fung.* 11: 1-753.
SACCARDO, P.A. and P. SYDOW. 1899. *Syll. fung.* 14: 1-1316.
SACCARDO, P.A. and P. SYDOW. 1902. *Syll. fung.* 16: 1-1291.
SACCARDO, P.A. and A. TROTTER. 1913. *Syll. fung.* 22: 1-1612.
SHEAR, C.L., N.E. STEVENS, and M.S. WILCOX. 1924. *Botryosphaeria* and *Physalospora* on currant and apple. *J. Agr. Res.* 28: 589-598.
STEVENS, N.E. and A.F. JENKINS. 1924. Occurrence of the currant cane blight fungus on other hosts. *J. Agr. Res.* 27: 837-844.
SUTTON, B.C. 1977. Coelomycetes VI. Nomenclature of generic names proposed for Coelomycetes. *Mycol. Pap.* 141: 1-253.
SUTTON, B.C. 1980. The Coelomycetes. Commonwealth Mycological Institute. 696 pp.

MYCOTAXON

Vol. XXX, pp. 127-132 October-December 1987

VACCINIUM FUNGI: CORYNESPORA ARCTESPORA, COMB. NOV.

L. M. CARRIS

Blueberry/Cranberry Research Center,
Rutgers University, Chatsworth, New Jersey 08019

The new combination Corynespora arctespora is proposed for Helminthosporium arctesporum Cooke & Ellis, a common species on stems of highbush blueberry (Vaccinium corymbosum L.) in southern New Jersey. Corynespora arctespora produces a phialidic synanamorph, a feature previously unreported in the genus.

Corynespora arctespora (Cooke & Ellis) Carris, comb. nov.
Figs. 1-7.
≡ Helminthosporium arctesporum M. C. Cooke & J. B. Ellis, Grevillea 6: 88. 1878.

Colonies effuse, brown to black. Mycelium immersed in the substratum, composed of branched, septate, medium brown, smooth-walled, 4-9 µm thick hyphae. Conidiophores (Figs. 1C, 2, 7) arise singly or in groups, erect, macronematous, mononematous, typically simple, rarely branched, thick-walled, straight or flexuous, brown, septate, 63-162 µm long, 4-6 µm wide, with up to 2 cylindrical proliferations. Conidiogenous cells tretic, integrated, terminal, cylindrical, brown. Conidia (Figs. 1A, 1B, 3, 4) formed singly or in chains; straight or flexuous, cylindrical to obclavate, thick-walled at base, thin-walled at apex, brown, paler near apex, smooth-walled, 2-20 distoseptate, 13-63 µm long, 4-7 µm wide.

Synanamorph (Figs. 1B, 1D, 5, 6). Phialides integrated or discrete; if discrete, single to botryose, ampulliform, hyaline to pale brown, with deep, cylindrical to flaring collarette, 6.7-12.1 x 2.7-4.0 µm, arising terminally or laterally from apical cell(s) of Corynespora conidia; if integrated, then collarette produced apically or laterally on hyphae-like extension of apical cell of Corynespora conidia. Phialoconidia hyaline, subglobose, single-celled, thin-walled, 1.7-4.0 µm diam; formed singly and then adhering in mass at apex of collarette.
HABITAT: On stems of Vaccinium spp.

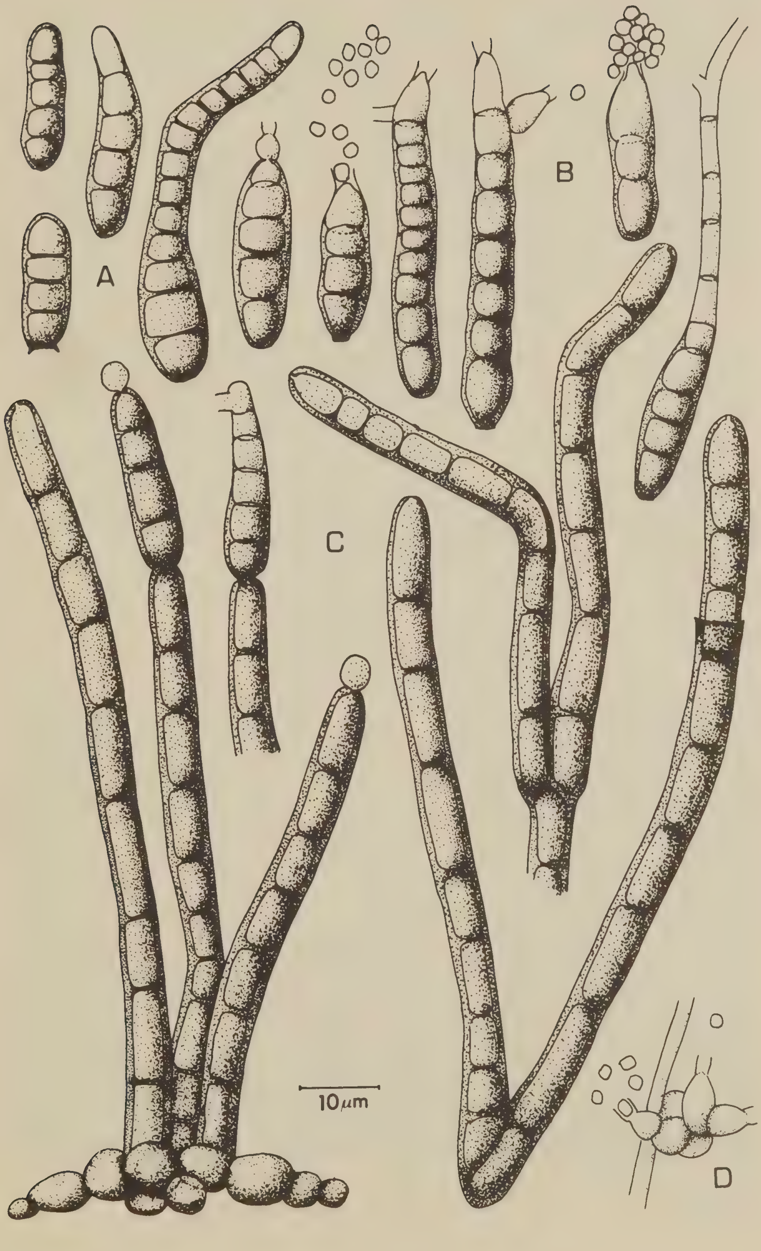
KNOWN DISTRIBUTION: Southern New Jersey, U.S.A. (Atlantic, Burlington and Gloucester Counties).
HOLOTYPE: 'Fungi-New Jersey. U.S.A. *Helminthosporium arctesporum* C. & E. on *Vaccinium*. No. 2659. Newfield; J. B. Ellis' in K (preparation in DAOM).
ISOTYPES: 'Ellis, North American Fungi. 46. *Helminthosporium arctaesporum* [*sic*], C. & E. (Grev., Vol. 6, p. 88). On dead twigs and limbs of *Vaccinium*' in DAOM and NYS (preparation in DAOM).
ADDITIONAL SPECIMENS EXAMINED: Burlington Co., NJ, on stems of *Vaccinium corymbosum* L., cultivar Concord, L. Carris, 2-XII-1986, BPI, NY, ILLS. Burlington Co., NJ, on *V. corymbosum* cultivar Pioneer, P. Marucci, 5-I-1987. Atlantic Co., NJ, on *V. corymbosum* cultivar Berkeley, P. Marucci, 17-IX-1986, BPI. Atlantic Co., NJ, on *V. corymbosum* cultivar Weymouth, L. Carris, 16-IX-1986.

Cooke and Ellis (1878) described and illustrated only dark, septate conidia in *Helminthosporium arctesporum*. Examination of preparations from holotype and isotype specimens of *H. arctesporum* revealed the presence of phialides on conidia of this fungus, and left no doubt that *H. arctesporum* provides an epithet for the *Corynespora* recently found on stems of cultivated blueberry in southern New Jersey.

Although the formation of a phialidic synanamorph is novel to *Corynespora*, in other respects *H. arctesporum* fits well in the genus. It forms terminal, monotretic, percurrent conidiogenous cells and typically solitary, obclavate, distoseptate conidia. *Corynespora arctespora* most closely resembles *C. cambrensis* Ellis in the shape and size of the conidiophores and primary conidia, but differs from *C. cambrensis* in forming occasional branched conidiophores and conidia with paler apices. I found no phialidic synanamorph in the type specimen of *C. cambrensis* (IMI 27369a).

The formation of the synanamorph is the most distinctive feature of *C. arctespora* and distinguishes it from other species of *Corynespora*. Hughes (1966) established the form genus *Capnophialophora* for similar morphs produced by several species of sooty molds. In both *Capnophialophora* and *Corynespora arctespora*, the phialides

Fig. 1A-D. *Corynespora arctespora*. A. Conidia. B. Phialides with phialoconidia formed from apex of conidia. C. Conidiophores. D. Cluster of phialides on germinal hyphae.


A
B
C
D
10µm

form directly from cells of macroconidia, or from germinal hyphae arising as an extension of these. Occasionally, phialides form in botryose clusters on germinal hyphae (Fig. 1D). The use of Capnophialophora is perhaps best restricted to species of sooty molds.

Phialides and phialoconidia were present in colonies of C. arctespora collected from the field, but were produced in larger numbers when stem sections were incubated 48 hr or more in a moist chamber. Corynespora conidia germinated within 24 hr on water agar (Bacto-Agar, Difco, Detroit, MI), but phialoconidia were not observed to germinate.

I found Corynespora arctespora on four cultivars of highbush blueberry at four different locations in Atlantic and Burlington Counties in southern New Jersey. On the cultivar Concord the fungus formed dense, black-brown colonies while on cultivars Berkeley, Weymouth and Pioneer the colonies were more effuse and less conspicuous. On all cultivars, colonies of C. arctespora frequently occurred on and around pseudothecia and pycnidia of Botryosphaeria corticis (Demaree & Wilcox) Arx & Muller, the blueberry stem canker fungus. Botryosphaeria corticis is a serious pathogen of blueberry (Taylor 1958), and additional work is needed to determine the extent and nature of the interaction between the two fungi.

ACKNOWLEDGMENTS

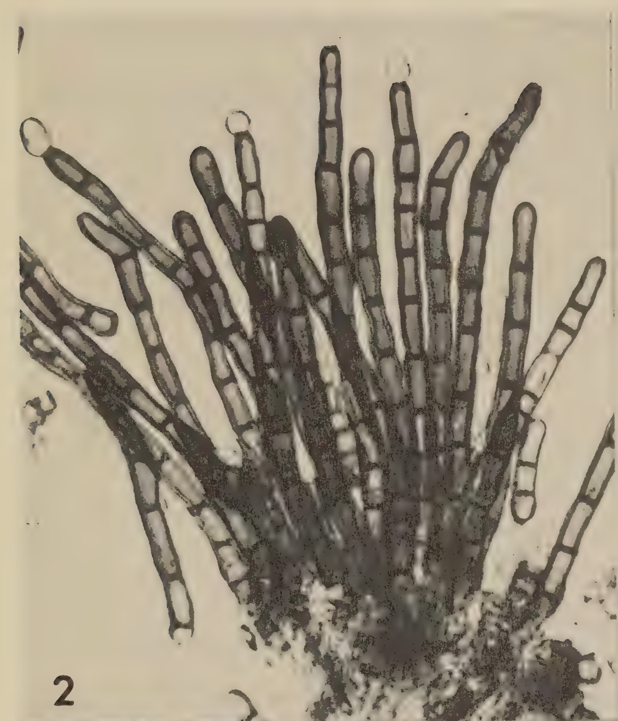
I am grateful to the curators at DAOM, IMI and K for the loan of specimens examined in this study. I wish to give special thanks to Dr. S. J. Hughes for valuable assistance in identification and for reviewing this manuscript, and Drs. J. L. Crane, D. A. Glawe and D. P. Rogers for advice and assistance.

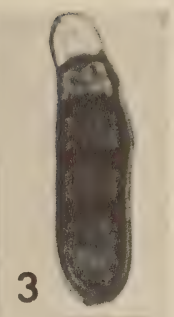
LITERATURE CITED

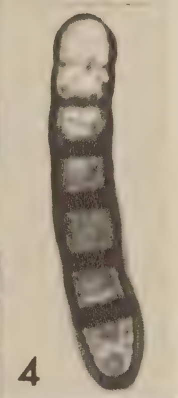
Cooke, M. C. and J. B. Ellis. 1878. New Jersey Fungi. Grevillea 6: 81-96.

Hughes, S. J. 1966. New Zealand Fungi 7. Capnocybe and

Figs. 2-7. Corynespora arctespora. 2. Conidiophores, X600. 3, 4. Conidia, X1800. 5, 6. Phialides with phialoconidia formed at apex of conidia, X1800. 7. Clusters of conidiophores on blueberry stem, X70.

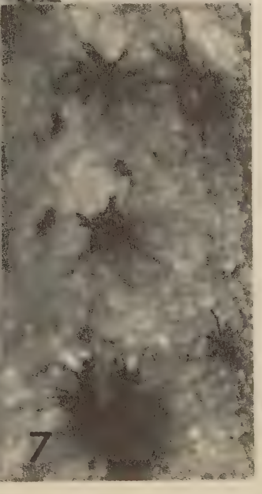

2


3


4

5

6


7

Capnophialophora, new form genera of sooty moulds. N. Z. J. Bot. 4: 333-353.

Taylor, J. 1958. Stem canker and related blueberry diseases. N. C. Agric. Exp. Station Tech. Bull. 132. 24 pp.

MYCOTAXON

Vol. XXX, pp. 133-148 October-December 1987

PERONOSPORA ON TWO CERASTIUM SPECIES IN NORTHERN EUROPE

ARNE GUSTAVSSON

University College of Jönköping
P. O. Box 1026 S-55111
Jönköping Sweden

ABSTRACT. Morphological studies of more than sixty collections of Peronospora on Cerastium semidecandrum and C. fontanum have shown that three taxa can be distinguished - P. paula on the former host species, P. conferta and P. fontana n. sp. on the other one. Measurements and illustrations are given of oospores, conidiophores, and conidia. The distribution of the three species in the Nordic countries is mentioned, and certain criteria used in Peronospora taxonomy are discussed.

INTRODUCTION

When I earlier studied Peronospora on Cerastium (8), I found that P. conferta (Unger) Unger is a parasite on C. fontanum Baumg. (syn. C. holosteoides Fr., C. viscosum L. p. p., C. vulgatum L., C. caespitosum Gilib., C. vulgare Hartm., C. triviale Link) and on some other species of the same genus. The fungus on C. semidecandrum did not fit into any of the known taxa, and I thus described it as a new species, P. paula. I regarded some material of the parasite on C. fontanum as P. paula, too, because my few collections did not permit other conclusions. With more material, collected in recent years, I have been able to study these fungi again.

MATERIAL AND METHODS

Peronospora on *Cerastium fontanum* and *C. semidecandrum* is known from about 130 localities in the Nordic countries. I have here selected about 60 of the best preserved collections from as many parts of this area as possible - 36 of these are my own findings. With 20 (in one case 21) collections of each parasite I believe I have covered most of the variation between different localities. About 200 oospores, 1300 conidiophores, and 5000 conidia were measured. The material studied has these origins:
Host *Cerastium fontanum*, fungus *Peronospora conferta* - collections made in 1876 - 1985 in Denmark (2 - E. Rostrup, AG - S, LD), Norway (3 - I. Jörstad, T. Ramsfjell, H. B. Gjaerum - O, NPPI), Sweden (15 - A. G. Eliasson, A. Nilsson, AG - S, LD).
Host *C. fontanum*, fungus NOT *P. conferta* - collections made in 1879 - 1986 in Finland (3 - L. E. Kari: F. exs. fenn. 16:764, H. Roivainen, AG - U, LD), Norway (11 - A. Blytt, I. Jörstad, T. Ramsfjell, H. B. Gjaerum - O, NPPI), Sweden (6 - H. v. Post, AG - S, LD).
Host *C. semidecandrum*, fungus *P. paula* - collections made in 1931 - 1984 in Sweden (20 - H. Christoffersson, AG - LD, and one with oospores only - N. Sylvén - LD).
(Herbarium abbreviations: L = Lund, NPPI = Norwegian Plant Protection Institute, Ås, O = Oslo, S = Stockholm, U = Uppsala.) I made the preparations by crushing small pieces of infected host parts - preferably from what looked like old infections - in lactophenol with methyl blue. Very few oospores are destroyed in this way. Some of them may instead come free from the host tissue and can thus be studied more in detail.

Earlier studies have not paid much attention to the relative height of "stem" and "crown" of the conidiophores. By measuring these parts separately I have tried to find new data (fig. 4 and 6B). I have also studied conidia using the standard method with methyl blue in lactophenol. The differences between the conidia of the three fungi studied here are shown in fig. 5 by an earlier used method (8) and in fig. 6A by adding length and breadth of the averages of the conidia in each collection. The latter method separates the various taxa almost completely.

RESULTS

OOSPORES . As mentioned above I have not found oospores of Peronospora conferta on Cerastium fontanum. The oospores of the new species described below for the same host species and those of P. paula on C. semidecandrum are seen in fig. 2 and 3. There is only one fully developed oospore in fig. 2, but the oogonium walls are seen in the other cases. In fig. 3B there are clear differences also between what must be mature or almost mature oospores. The epispores in B1 and B2 are of different thickness and of varying shape. They are not just "reticulate" but are equipped with a system of winding walls with a height of 3 - 5 or sometimes as much as 6 - 8 um. The spaces between the walls vary in shape and size, also between different oospores. I have shown this also by photographs in an earlier paper (7). I measured the oospores of Peronospora n. sp. and P. paula. The measurements - including the wall reticulum - have given the following results.

Tab. 1 (averages between brackets).

Species	Coll. no.	No. of oosp.	Lenght um	Breadth um	Quotient
P.n.sp.	4	22	33.1-45.5 (38.2)	31.5-39.3 (35.2)	1.00-1.22 (1.09)
	16	100	29.0-47.6 (37.8)	26.9-43.5 (35.9)	1.00-1.22 (1.05)
P.paula	21	100	31.1-45.5 (38.9)	29.0-43.8 (37.5)	1.00-1.11 (1.04)
	2	4	35.2-41.4 (38.3)	35.2-41.4 (37.3)	1.00-1.06 (1.03)

The first two collections are from Norway and collected in Finnmark in 1879 by A. Blytt (O) and in Sogn og Fjordane in 1966 by H. B. Gjaerum (NPPI). The material of P. paula is from Sweden and found in Skåne in 1931 by N. Sylvén and from öland in 1984, collected by myself (both LD). The first of these two collections is not represented in fig. 4 - 6, as there are hardly any conidiophores or conidia.

It might appear as if the oospores of the new species are somewhat smaller and less rounded than those of P. paula. To make conclusions like that after studying only a little more than 200 oospores from a few localities is, not possible, of course. P. conferta may not develop any oospores, and this is perhaps a difference between this and the other two species.

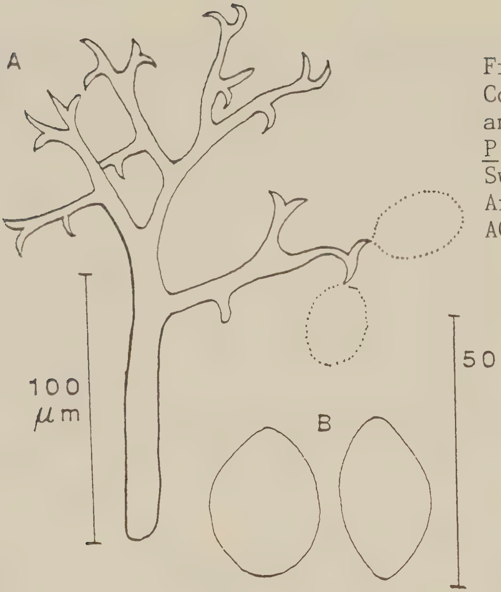


Fig. 1
Conidiophore
and conidia of
P. conferta.
Sweden, Lapland,
Arjeplog 1983
AG (LD).

However, oospores are often hard to find even in a host where they really occur, and more collections should be studied before any statement in this direction can be made.

I have been facing an unexpected problem when studying oospores in lactophenol. I have never found any change in the size of the conidia if these are kept in lactophenol on slides for weeks or even months, but the oospores seem to behave differently, at least in some cases - various wall thickness may give divergent results. The oospores can apparently take up fluid during the storage and may swell to a considerable extent. I have seen the "equatorial diameter" increased as much as 30 %. If conidia take up fluid during preparation in lactophenol, they seem to do so at once. Similar experiences concerning conidia have been recorded by Ben-Ze'ev and Kenneth (1). I have not been able to find out which is the natural size of the oospores in this case, as there has been no really fresh material available. The measurements given for oospores in this paper were made just after preparing the material and should give figures close to the real size.

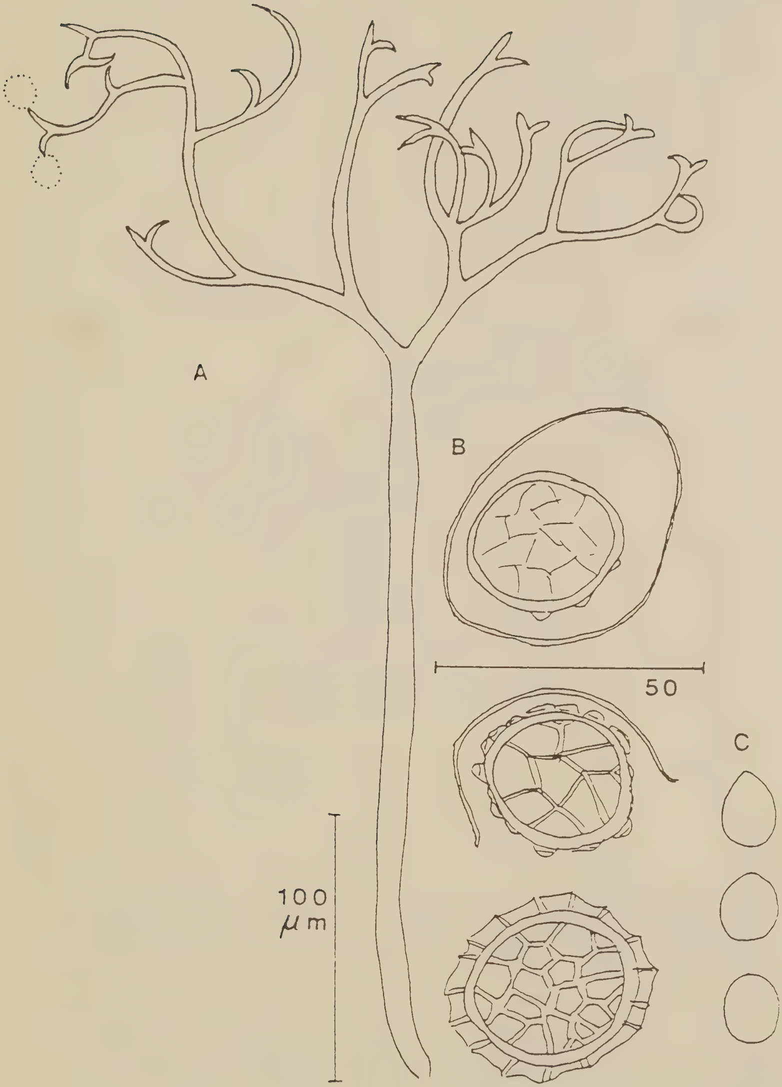


Fig. 2 Conidiophore, oospores, and conidia of Peronospora fontana. A and C are from the type collection, B from the Norwegian collection mentioned in the text.

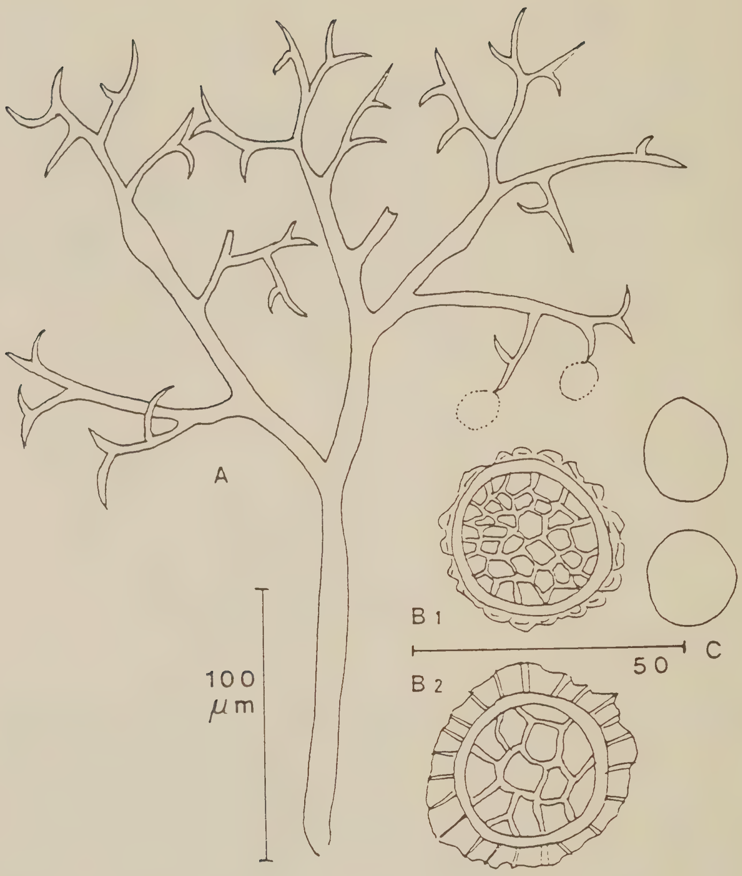


Fig. 3 Conidiophore, oospores, and conidia of Peronospora paula. A and C are from Sweden, Östergötland, V. Tollstad 1984 AG (LD), B 1 from Sweden, Skåne, Limhamn 1931 N. Sylvén (LD), and B 2 from Sweden, Öland, Föra 1984 AG (LD).

Fig. 4 (opposite page) Variation in the conidiophore stems given as lines. Averages are shown by dots or crosses. The collections are arranged with the highest averages first for each species.

Fig. 5 (one page later) Size of the conidia of the three species. Gray parts show the total areas covered by conidia, and marks give averages.

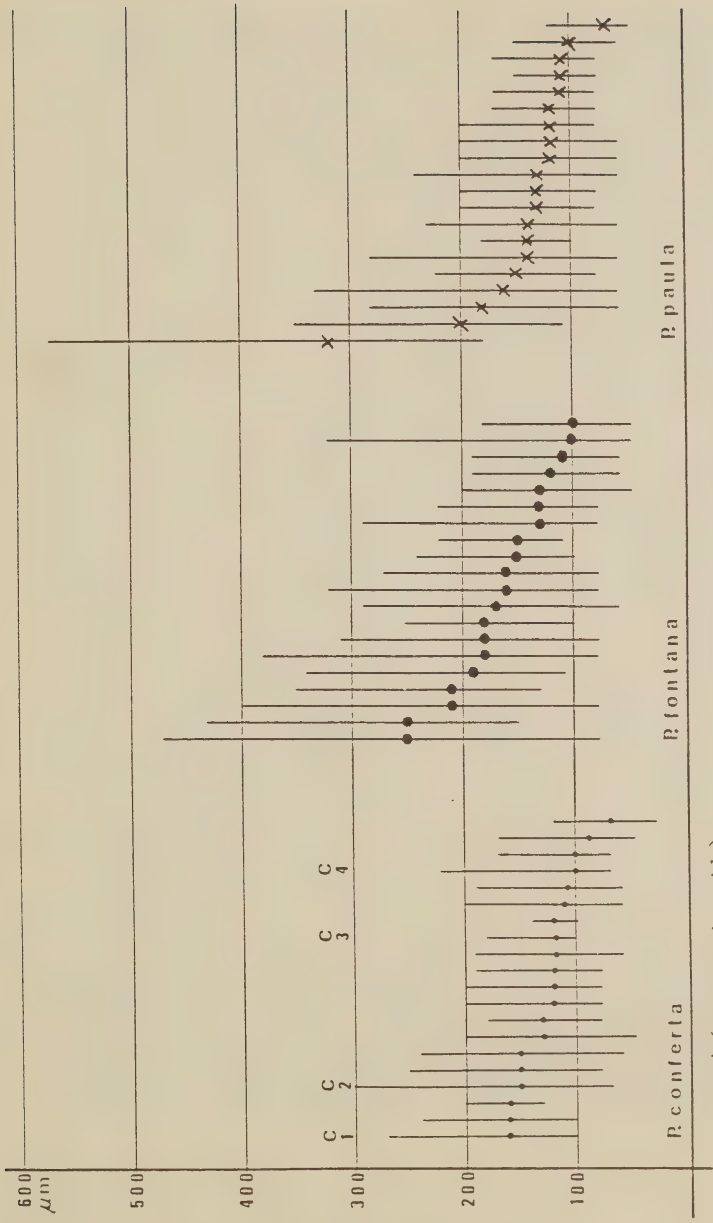


Fig. 4 (see opposite side)

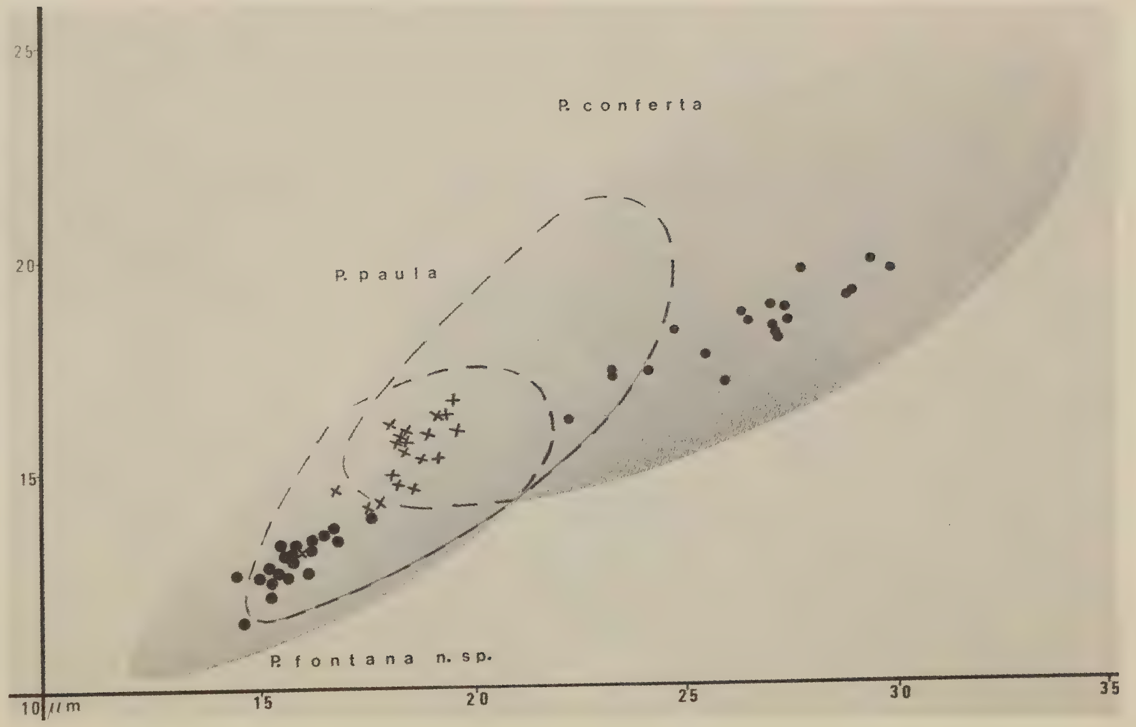


Fig. 5 Legend under fig. 3 (two pages earlier).

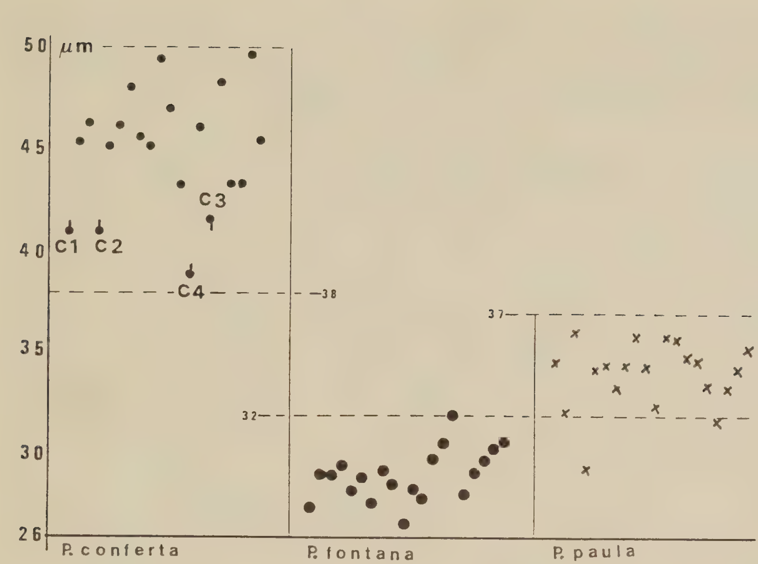
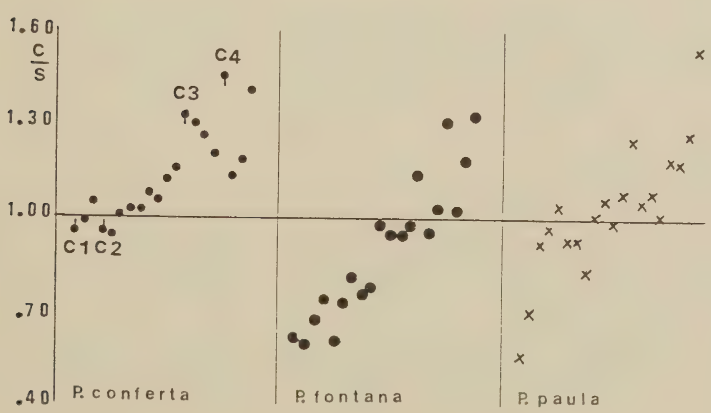


Fig. 6A Sizes of the conidia shown by adding averages of length and breadth for each collection. Tabulation as in fig. 4

Fig. 6B Relation between crown and stem of the conidiophores (C:S). Marks below the 1.00-line thus show that the stem average is higher than that of the crown, and vise versa. Tabulation as in fig. 4.



Tab. 2. Size of conidiophores and conidia in collections with largest and smallest figures and in control collections C1-C4. Collection numbers after tabulation in fig. 4 and 6, arranged after falling average height of the conidiophore stems of each species. Averages are given in the middle of the columns.

Coll. number	Stem height µm	Crown height µm	Total height µm	Number studied
P. conferta - conidiophores				
1 (= C1)	100-160-270	110-150-200	230-430	30
4 (= C2)	70-150-300	110-140-200	200-440	16
13(= C3)	100-120-180	120-170-250	210-380	22
17(= C4)	70-100-220	100-160-210	200-370	23
20	30- 70-120	50-100-150	130-240	43
Totally	30-270	50-270	130-450	463
P. fontana n. sp. - conidiophores				
1	80-250-470	80-150-240	210-630	22
20	50-100-180	70-130-200	130-330	36
Totally	50-470	60-240	130-630	400
P. paula - conidiophores				
1	180-320-560	110-180-270	360-750	14
20	50- 70-120	60-110-150	130-220	18
Totally	50-560	60-270	130-750	477

Coll. number	Length µm	Breadth µm	Quotient	Number studied
P. conferta - conidia				
1 (= C1)	20.7-23.4-29.0	14.5-17.5-20.7	1.22-1.34-1.70	100
4 (= C2)	20.7-23.3-26.9	14.5-17.6-22.8	1.22-1.32-1.63	50
13(= C3)	18.6-22.3-29.0	14.5-16.5-18.8	1.14-1.35-1.43	100
17(= C4)	20.7-24.9-29.0	14.5-18.3-22.8	1.18-1.36-1.56	100
19	24.8-30-0-37.3	16.6-19.6-24.8	1.33-1.53-1.80	100
Totally	18.6-26.6-37.3	14.5-18.4-24.8	1.11-1.45-1.89	1763
P. fontana n. sp. - conidia				
1	12.4-14.7-16.6	10.4-12.8-14.5	1.00-1.15-1.33	100
15	14.5-17.7-16.6	12.4-14.3-16.6	1.13-1.24-1.33	39
Totally	12.4-15.8-20.7	10.4-13.3-16.6	1.00-1.19-1.50	1553
P. paula - conidia				
17	14.5-16.9-18.6	12.4-14.9-16.6	1.00-1.13-1.29	67
3	16.6-19.5-22.8	14.5-16.6-18.6	1.00-1.17-1.43	100
Totally	14.5-18.5-26.9	12.4-15.6-20.7	1.00-1.18-1.43	1714

CONIDIOPHORES. To control my material of *Peronospora conferta* I have used special control collections, called C1 - C4 in fig. 4 and 6. They are from the same locality, Mt Njulla in the northernmost part of Swedish Lapland and were collected at the same time, in August 1983, just a few meters from each other in a vast population of *Cerastium fontanum* ssp. *scandicum* H. Gartner. It is thus likely that differences between the four collections depend on the natural variation and not on differences in the host population or the environment. Tab. 2 shows that the total height of the conidiophores is similar in the control collections - there is a greater difference between these taken together and collection 20, for example. However, the averages of the stem height vary considerably also between the controls. It is interesting that most of the variation observed is covered by the control material. It should also be noted that the controls together give a much better picture of the fungus in one place than what would have been obtained from just one single collection.

It is also seen from tab. 2 that the conidiophores of *Peronospora* n. sp. and of *P. paula* are in many cases much taller than those of *P. conferta*. The differences are mainly confined to the stems, and the crowns do not differ very much. This is clear also from fig. 1 - 3. When all 20 collections of each species are taken into consideration, the variation in stem height is strikingly wide within every species. The relation between smallest and tallest stems is about 1:10, whereas corresponding relation for the crowns is just about 1:5 or less. The great stem variation made me choose this character for the arrangment of fig. 4 and 6.

The lines with dots or crosses for averages in fig. 4 show the stem variation within each collection - it is smaller for *P. conferta* than for the other species, also when it comes to the relation between different collections.

The relation between the heights of the crowns and the stems is given in fig. 6B. *P. conferta* has in most cases a crown taller than the stem, shown in the figure by dots above the line for 1.00. There is a clear difference between controls C1 and C2 on one side and C3 and C4 on the other. I have made no special study in order to explain this difference. *Peronospora* n. sp. and *P. paula* show conidiophores with tall stems and rather low crowns in some cases but with smaller stems and higher crowns in others (fig. 6B). The difference between these species and *P. conferta* is still very clear.

I have not been able to use the width of the crowns in this investigation. Their height can be measured without problems, but they are often twisted or otherwise deformed during the preparation in such a way that the width has been changed too much.

CONIDIA. The results of the conidia measurements are shown in tab. 2 and fig. 5. The second part of the former gives the results from the collections with the smallest and largest conidia and for the controls of *Peronospora conferta*. The total variation in the 20 collections of each species is very wide – the longest conidia in one collection of *P. conferta* are about twice as long as the shortest, also mature, conidia in another collection. In two other cases the variation from smallest to largest is for *Peronospora* n. sp. almost 70 % and for *P. paula* about 85 %. The breadth varies in a similar degree, and, consequently, the shape is very much the same in different collections of the same species. *P. conferta* has much larger conidia than the other two species, and they are also more elongated.

This is very clear also from fig. 5, where the averages for the 60 collections of the three species are given as crosses (*P. paula*) or dots (the other two species). The gray parts give the total areas covered by the conidia of the different species. These are separated very well in this picture, and the great difference between the two parasites on *Cerastium fontanum* is very well shown.

Comparing fig. 4 and 6A, where the collections are arranged in the same order – those with the tallest conidiophore stems first – one observes that the size variation of the conidia does not follow the variation of the conidiophores. Taller conidiophores do not produce larger conidia, and the shortest conidiophores do not have the smallest conidia.

DISTRIBUTION OF THE THREE SPECIES IN THE NORDIC COUNTRIES. It is beyond the limits of this paper to show the results of field investigations by distribution lists or maps for these fungi. However, *Peronospora conferta* has been found on *Cerastium fontanum* (ssp. *triviale* /Link/ Jalas and ssp. *scandicum* H. Gartner, not separated here) in about 50 localities in Denmark, Finland, Norway, and Sweden, from the southern part to the northernmost districts (10). *P.* n. sp. is known from about 10 places in Norway and from a similar number in different parts of Sweden. A few localities are also known from Finland but none from Denmark. *P. paula* on *Cerastium semidecandrum* is known from about 25 places in South Sweden and a few in Denmark. It probably follows its host. It seems that this parasite can be found in most host localities, whereas the two fungi on C. fontanum in most cases are searched for in vain.

Jörstad (11) suspects that "the small-spored form", the species described as new here, can be found further north in Norway than the other form (P. conferta), and that it is spread to higher altitudes - at least 1020 m. - than this one (660 m.). The general distribution of these species in the Nordic countries also indicates differences, as far as can be seen from known collections - Peronospora n.sp. appears to be distributed more to the north and, perhaps, to the west, whereas P. conferta has been found more to the south.

DISCUSSION AND CONCLUSIONS.

As stated above the oospores have not been very helpful as separating characters for the Peronospora species studied here. They are not known for P. conferta and may not be developed there, as discussed above, but the differences between the other two species are very small. The size of the oospores appears to change to a certain extent during storage in lactophenol. This has been of no importance in this stydy, where I had only my own measurements to compare. In other cases, however, there may be considerable discrepancies between oospore measurements given by different authors for the same Peronospora. The cause may thus be variations in preparation methods or in age between collections or preparations studied.

I have earlier (8,9) rejected Gäumann's method of describing new species after finding small differences in conidial size between only two collections. Studying what I suspected to be an undescribed Peronospora on Cerastium fontanum differing from P. conferta on the same host and from P. paula on C. semidecandrum, I thus knew that results from single collections would give incomplete and, most likely, wrong results. The number of available collections and the results obtained during the studies led me to choose twenty collections of each species.

With a variation of conidiophores and conidia like the one found here, it is, of course not recommendable to describe a species with only one collection as a basis. This means that numerous species, erected by Gäumann and others, must be reviewed. It should be observed - this has not always been done - that several of Gäumann's species, e.g. those within the wide unit of P. "parasitica" - were established only after careful studies with infection experiments (4).

Peronospora paula is a good example, where it has been somewhat unsafe to describe a species after limited studies (8). I used five collections in that case, and the selected type material - no. 4 in fig. 4 and 6 - is satisfying in other respects but differs from other collections in fig. 6, when conidial length and breadth are added. More material would certainly have been helpful when I tried to choose a good type - the material presented in this paper would have improved the result. On the other hand, the type collection of Peronospora fontana n. sp. has been carefully selected among twenty of the best collections available. There are, however, no oospores in the type material. Only in one collection, the one from Norway mentioned above, did I find enough of well preserved oospores to get reliable results. There are rather few conidiophores and conidia in this Norwegian material, and I thus decided against using it as the type collection - it would have been too incomplete, even if it contains the oospores.

Because of the uncritical methods used by Gäumann and his followers certain scientists, mainly plant pathologists, refuse to accept other Peronospora species than the old, often very wide ones, in most cases established during the last century, sometimes by using methods as uncritical as those used by Gäumann. I think it is necessary to discuss this problem again. When there are two Peronospora species on the same host species, e. g., Cerastium fontanum as in my case, and they differ from each other in almost every respect, it cannot be rational still to put these and related fungi together and just call them Peronospora alsinearum or something else. If differences presented in this paper should not be accepted as species-separating, it is hardly possible to use any morphological species concept within Peronospora at all. To erect "subspecies","forms" or other taxa of lower value would only increase the confusion. It can easily be said that new species should be founded on infection experiments, but, waiting for this to happen in a future, we would not be able to handle the taxonomy of these parasites during the meantime.

Gäumann (4) found that often, and even when he had fresh collections, he did not have enough material or enough good material to start an infection on his test plants. I have made similar experiences. Inoculations with uredospores of, e. g. cereal rusts seldom fail if the infected plants are susceptible, but experiments of that kind are much more difficult with Peronospora. Conidia of certain species mostly germinate very well during various conditions, but those of other species do not germinate at all or only to a very limited extent. There seem to be several problems to be solved here, before reliable cross-inoculations can be made. .

There are only few cases where two Peronospora species have been found on the same host species. P. alta Fuck. and P. plantaginis Burrill (12) on Plantago major have been reported also by Golenia for Poland (6) and by Constantinescu and Negrean for Romania (2). The latter authors even list P. parasitica (Pers.: Fr.) Fr. and P. lepidii (McAlp.) Wils., both on Lepidium densiflorum (L.) Schrad (2, 3).

Peronospora fontana A. Gust. n. sp.

Caesputilis densis, griseo albis, totum tergum foliorum subtegentibus. Conidiophoris 200-600 µm altis; trunco 1/2 - 2/3 totius altitudinis efficienti. Ramis 4 - 7ies dichotome ramosis, curvatis; furcis terminalibus leviter curvatis vel rectis. Conidiis 13 - 19 µm longis, 11-16 µm latis. (Oosporis 29 - 47 x 27 - 44 µm, episporio reticulato.) Habitat in foliis vivis Cerastii fontani Baumg.

Holotypus: Sweden, Gotland, Vallstena, 4 June, 1986, AG 7206 (LD).

The conidiophore layer is rather thick with a grayish white color. It often covers the whole underside of the leaves. The conidiophores are 200 - 600 µm high; their stems are 1/2 - 2/3 of this. The branches of the crown are curved, dichotomously divided 4 - 7 times, and the end branches are slightly curved or straight. The conidia measure 13 - 19 x 11 -16 µm. The type collection does not contain oospores, but these are abundant in a collection from Norway - Sogn og Fjordane, Sogndal, 23 July 1966, H. B. Gjaerum (NPPI), where, on the other hand, conidiophores and conidia are comparatively few. The size of these oospores is 29 - 47 x 27- 44 µm, and their epispore is more or less reticulate or has a pattern of winding walls. Host plant is Cerastium fontanum Baumg.

ACKNOWLEDGEMENTS

Dr. O. Constantinescu, Department of Systematic Botany, Uppsala, Sweden, has reviewed the manuscript and has suggested valuable improvements. Dr. H. B. Gjaerum, Norwegian Plant Protection Institute, Ås, has been helpful with the Norwegian material. The work has been supported by the University of Linköping and the University College of Jönköping, both in Sweden.

LITERATURE CITED

1. BEN'ZEEV, I.S. & KENNETH, R.G. 1987 A biometric study in Peronosporaceae: influence of water, lactophenol, and pregermination swelling on conidial dimensions. - Mycologia 79(4). In press.
2. Constantinescu, O. & Negrean, G. 1983 Additions to Romanian Peronosporales. - Feddes Rep. 94: 263 - 277.
3. Ibid. 1983 Check-list of Romanian Peronosporales. - Mycotaxon 16: 537 - 556.
4. Gäumann, E. 1918 Ueber die Formen der Peronospora parasitica (Pers.) Fries. - Centralbl. Bact. I. Beiheft 35: 1 - 145.
5. Ibid. 1923 Beiträge zu einer Monographie der Gattung Peronospora Corda. - Beitr. Kryptogamenfl. Schweiz V, 4 Zurich.
6. Golenia, A. 1959 Peronospora alta Fuckel i P. plantaginis Burrill in Underwood emend. na babce zwyczajnej Plantago major L. w Polsce. (Pol., Eng. summ.) - Monogr. Bot., Warsaw,8:221-228.
7. Gustavsson, A. 1959 Studies on the oospore development in Peronospora. - Bot. Not., Lund, 112: 1 - 16.
8. Ibid. 1959 Studies on Nordic Peronosporas. I. Opera Botanica, 3 - 1, Lund.
9. Ibid. 1959 Studies on Nordic Peronosporas. II. Opera Botanica, 3 - 2.
10. Ibid. 1985 The genus Peronospora in the Torneträsk area, N Sweden. - Sven. Bot. Tidskr., Stockholm, 79: 375 - 388.
11. Jörstad, I. 1964 The Phycomycetous genera Albugo, Bremia, Plasmopara, and Pseudoperonospora in Norway, with an appendix containing unpublished finds of Peronospora. - Nytt Mag. Bot., Oslo, 12: 135 - 144.
12. Underwood, L. M. 1897 Some new fungi, chiefly from Alabama. - Torrey Bot. Club, Bull. 24: 81 - 86.

MYCOTAXON

Vol. XXX, pp. 149-156 October-December 1987

A NEW NAME FOR PHIALOCEPHALA ILLINI

Michael J. Wingfield

Plant Protection Research Institute, Private Bag
X5017, Stellenbosch 7600, Republic of South Africa.

Two genera remain in the Leptographium complex (Kendrick, 1961; Kendrick, 1962) now that Verticicladiella Hughes has been reduced to synonymy with Leptographium Lagerberg and Melin (Wingfield, 1985). These two genera, Leptographium and Phialocephala Kendrick are distinguished by percurrent as well as sympodial proliferation of conidiogenous cells in Leptographium compared with conidia produced from distinct phialides in Phialocephala. Conidium development in Phialocephala spp. is, however, variable and the genus includes species producing conidia either by replacement or ring wall building (Wingfield, 1985). In a more detailed study of conidium development in Phialocephala spp. (Wingfield, Van Wyk and Wingfield, 1987) some unusual features of P. illini Crane, inconsistent with features of other Phialocephala spp. were noticed. These unusual features and a more appropriate generic placement for P. illini are considered here.

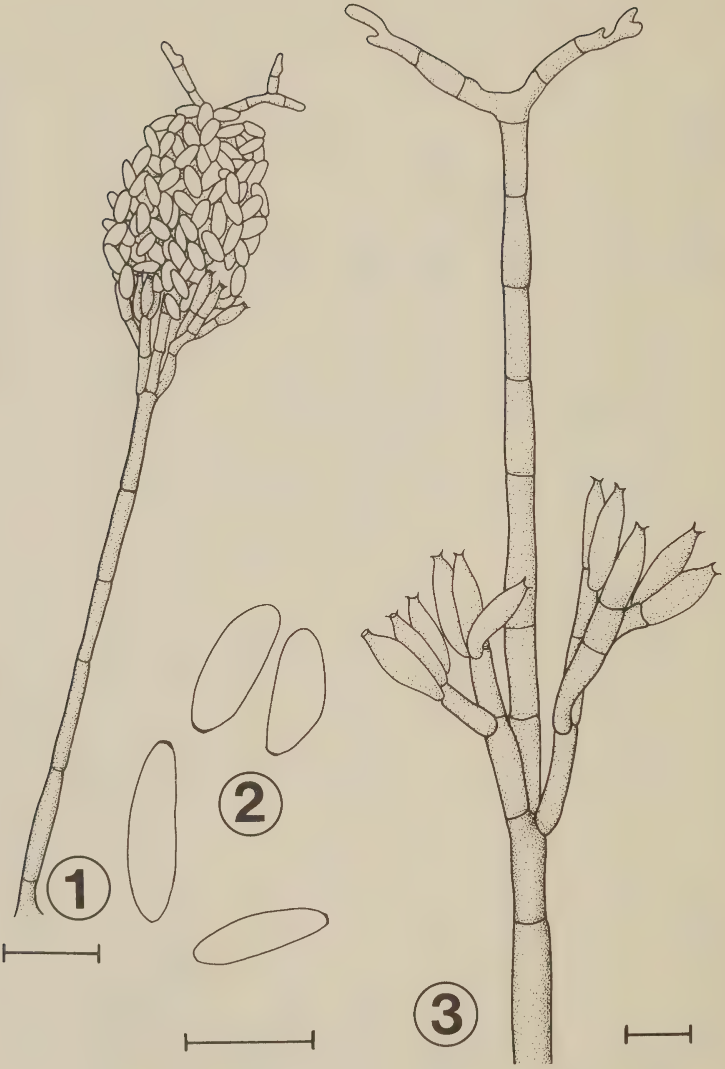
Crane (1971) described P. illini from decayed wood of Taxodium distichum (L.) Richard in Illinois. This species was distinguished from other Phialocephala spp. by a conidiogenous apparatus, laterally oriented on the upper third of an "occasionally branched and once or twice dichotomously forked" stipe (Figs. 1-3). All other Phialocephala spp. have conidiogenous cells terminal on the conidiophore and this necessitated an amendment of the generic circumscription of Phialocephala to accomdate P. illini (Crane, 1971).

In addition to the peculiar stipe, the conidia of P. illini, are unusually large among apical wall building Phialocephala spp. (Table 1). These features have led to a consideration of other genera in which

TABLE 1. **Comparison of conidial dimensions in species of *Chaetopsina* and apical wall building species of *Phialocephala*.**

Species	Conidial length	Conidial width	Source
Chaetopsina catenulata Samuels	12.0 - 16.0 µm	2.5 - 3.5 µm	Kirk & Sutton (1985)
C. fulva Rambelli	8.0 - 12.0 µm	1.5 µm	" "
C. penicillata Samuels	9.5 - 23.0 um	6.0 - 10.5 µm	" "
C. polyblastia Samuels	17.0 - 25.5 µm	4.0 - 5.5 µm	" "
C. splendida Sutton & Hodges	9.5 - 12.0 µm	1.5 µm	" "
Phialocephala dimorphospora Kendrick	3.6 - 5.4 µm (First conidium)	2.3 - 2.8 µm	Kendrick (1961)
	1.7 - 2.4 µm (Subsequent conidia)	1.7 - 2.4 µm (Globose)	
P. canadensis Kendrick	1.4 - 2.2 µm	2.2 - 3.6 µm	" "

P. flumninis Shearer, Crane & Millar	2.0 - 3.0 µm	1.0 - 1.6 um	Shearer, Crane & Millar (1976)
P. fortini Wang & Wilcox	3.0 µm (First conidium)	1.0 - 1.5 µm	Wang & Wilcox (1985)
	1.5 - 2.0 µm (Subsequent conidia)	1.5 - 2.0 µm (Globose)	
P. fusca Kendrick	2.0 - 4.8 µm	1.0 - 2.6 µm	Kendrick (1963)
P. humicola Jong & Davis	2.0 - 4.0 um	1.0 - 2.0 µm	Jong & Davis (1975)
P. illini Crane	10.0 - 12.3 µm	2.3 - 4.1 um	Crane (1971)
P. mexicana Onofri & Zucconi	7.2 - 10.0 um	1.0 - 1.8 um	Onofri & Zucconi (1984)
P. phycomyces (Auesw.) Kendrick	3.0 - 5.4 µm	1.7 - 3.0 um	Kendrick (1964)
P. repens (C. & E.) Kendrick	1.6 - 2.8 µm	1.6 - 2.8 µm (Globose)	Kendrick (1963)
C. xalapensis Persiani & Maggi	3.0 - 4.0 µm	1.8 - 2.0 µm	Maggi & Persiani (1984)



Figs. 1-3. *Chaetopsina illini*. Fig. 1. Conidiophore with conidia (bar = 25 μ). Fig. 2. Conidia (bar = 10 μ). Fig. 3. Apex of conidiophore with conidiogenous cells and branched seta (bar = 10 μ).

this fungus might be more appropriately placed. A potential genus was *Chaetopsina* which includes species with setose conidiophores and large conidia such as those found in *P. illini*. For this reason type material of *P. illini* (ILLS 34911) was examined and compared with that of *C. penicillata* Samuels (Dumont-EC 609: NY) which has conidia resembling *P. illini*. Previously reported conidial dimensions of other *Chaetopsina* spp. and *Phialocephala* spp. were also compared (Table 1).

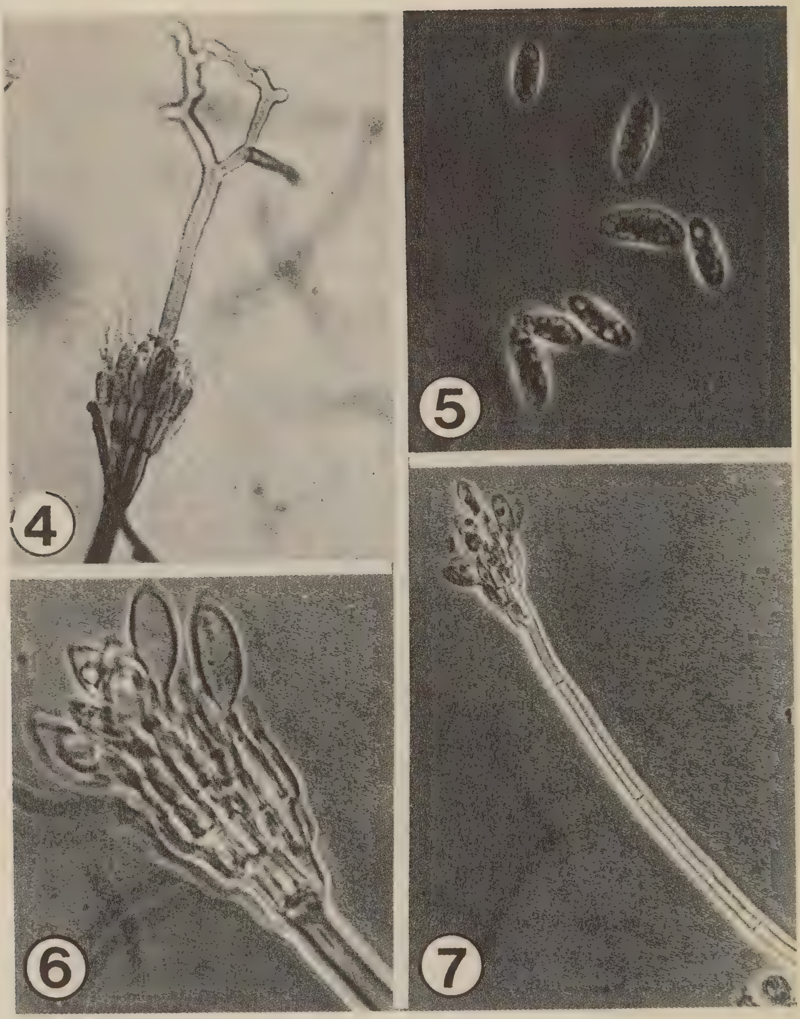
Samuels (1985) described three new species of *Chaetopsina* that were all anamorphs of the teleomorph genus *Nectria* (Fr: Fr.) Fr. (Hypocreales). These *Chaetopsina* spp. all have red brown, setose conidiophores that turn yellow in 100 % lactic acid. In a recent reassessment of *Chaetopsina*, Kirk and Sutton (1985) restricted the genus to the above characteristics and included only five species in this genus. In view of these recently recognised characteristics of *Chaetopsina*, the colour of conidiophores in *P. illini* was examined more closely. These were found to be red brown and turned yellow in 100 % lactic acid typical of *Chaetopsina* spp. The setose conidiophores, large conidia and conidiophore colour suggest that this fungus is more appropriately accomodated in *Chaetopsina*. The following synonymy is therefore proposed:

Chaetopsina illini (Crane) Wingfield comb. nov.
Phialocephala illini Crane Trans. Br. Mycol. Soc. 56: 162 (1971).

Chaetopsina illini most closely resembles *C. penicillata* (Figs. 4-7) but is easily distinguished from all *Chaetopsina* spp. by its forked or branched setae. These observations are based entirely on morphological characteristics of an anamorph. Ideally, knowledge of the teleomorph of *C. illini* would be desirable as *Chaetopsina* appears to best be restricted to anamorphs of *Nectria*.

ACKNOWLEDGEMENTS

I am grateful to curators of the Illinois Natural History survey and the New York Botanical Garden for



Figs. 4-7. *Chaetopsina illini* and *C. penicillata*. Fig. 4. Apex of *C. illini* conidiophore with conidiogenous apparatus and branched seta, X 1000 Fig. 5. Conidia of *C. illini*, X 1600 Fig. 6. Apex of *C. penicillata* conidiophore with conidia, X 1750 Fig. 7. Conidiophore of *C. penicillata*, X 700.

the loan of herbarium material and to P. Chesselet for assistance in preparing the diagrams. I also thank Drs. Gary J. Samuels and Sharon von Broembsen for advice and review of the manuscript.

LITERATURE CITED

CRANE, J.L. (1971). Illinois fungi II. A new species of Phialocephala. Transactions of the British Mycological Society 56, 160-163.

JONG, S.C. & DAVIS, E.E. (1975). Phialocephala gabalongi as a synonym of Phialocephala humicola. Mycotaxon 3, 126-128.

KENDRICK, W.B. (1961). The Leptographium complex. Phialocephala gen. nov. Canadian Journal of Botany 39, 1079-1085.

KENDRICK, W.B. (1962). The Leptographium complex. Verticicladiella Hughes. Canadian Journal of Botany 40, 771-797.

KENDRICK, W.B. (1963). The Leptographium complex. Two new species of Phialocephala. Canadian Journal of Botany 41, 1015-1023.

KENDRICK, W.B. (1964). The Leptographium complex. Hantzschia Auerswald. Canadian Journal of Botany 42, 1291-1295.

KIRK, P.M. & SUTTON, B.C. (1985). A reassessment of the anamorph genus Chaetopsina (Hyphomycetes). Transactions of the British Mycological Society 85, 709-718.

MAGGI, O. & PERSIANI, A.M. (1984). Codinaea coffeae and Phialocephala xalapensis. Mycotaxon 20, 251-258.

ONOFRI, S. & ZUCCONI, L. (1984). Two new species of the genus Phialocephala. Mycotaxon 20, 185-195.

SAMUELS, G.J. (1985). Four new species of Nectria and their Chaetopsina anamorphs. Mycotaxon 22, 13-32.

SHEARER, C.A., CRANE, J.L. & MILLAR, M.A. (1976). Illinois fungi 6. Two new species of wood-inhabiting Hyphomycetes from freshwater. Mycologia 68, 184-189.

WANG, C.J.K., & WILCOX, H.E. (1985). New species of ectendomycorrhizal and pseudomycorrhical fungi: Phialophora finlandia, Chloridium paucisporum, and Phialocephala fortinii. Mycologia 77, 951-958.

WINGFIELD, M.J. (1985). Reclassification of *Verticicladiella* based on conidial development. Transactions of the British Mycological Society 85, 81-93.

WINGFIELD, M.J., VAN WYK, P.S. & WINGFIELD, B.D. (1987). Reclassification of *Phialocephala* based on conidial development. Transactions of the British Mycological Society (In press).

158 20 *for* veracrusis *read* veraecrucis

MYCOTAXON

Vol. XXX, pp. 157-176 October-December 1987

NEW RECORDS OF LACTARIUS IN MEXICO *

GONZALO GUEVARA G., JESUS GARCIA J.,
JOSE CASTILLO T.

Departamento de Biologia
Instituto Tecnologico de Cd. Victoria,
Apartado Postal 175, Cd. Victoria Tamaulipas,
87010, Mexico

and
ORSON K. MILLER, JR.

Department of Biology
Virginia Polytechnic Institute
and State University
Blacksburg, VA 24061, U.S.A.

SUMMARY

Ten _Lactarius_ species are described, of which _Lactarius argillaceifolius_, _L. fuliginellus_, _L. fumosus_, _L. gerardii_, _L. lignyotellus_ cf. _texensis_, _L. olympianus_, _L._ cf. _pterosporus_, _L. piperatus_ var. _glaucescens_ and _L. speciosus_ are new records from Mexico. Ecological observations, distribution and illustrations are presented for all species.

INTRODUCTION

In northeast Mexico, there are many species of _Lactarius_ that are found in different vegetation types such as conifer forest (_Pinus, Abies, Pseudotsuga_ and _Picea_), mixed forest (_Pinus-Quercus_), _Quercus_ forest, hardwood forest (_Quercus, Fagus, Liquidambar, Acer_, etc.), and some xerophytic habitats with mixed _Quercus_ forest. Many of the fungi of these habitats have

---

* Project financed by COSNET (SEP) in Mexico

SEE ERRATA

not been studied and recorded for the Mexican flora. There are some reports of *Lactarius* in Mexico by mexican and north american mycologists but the genus is still poorly known from the above regions. Castillo, et al. (1979) recorded *Lactarius camphoratus, L. indigo, L. insulsus* in Nuevo Leon State, G-Ocanas (1985) also worked in Nuevo Leon and recorded *L. volemus, L. subdulcis* and *L. scrobiculatus.* Varela and Cifuentes (1979) recorded *L. chrysorheus, L. deliciosus* and *L. piperatus* from Hidalgo State. Frutis and Guzman (1983) recorded *L. rufus, L. subdulcis, L. sanguifluus* and *L. salmonicolor* from Hidalgo State. Guzman and Guzman (1979) recorded *L. vellereus, L. deceptivus* and *L. scrobiculatus* for southeast Mexico. Singer (1975) has studied *Lactarius* in Mexico and has recorded *L. indigo, L. fuliginosus, L. scrobiculatus* and *L. deliciosus* from south Mexico. Singer (1973) discovered and described *L. veracrusis* from Veracruz State.

All materials in the current study were collected from the Coastal Plains States of Nuevo Leon, Tamaulipas, Durango and Veracruz. Duplicates of all specimens are deposited at ITCV and VPI. The microscopic observations follow the procedures of Largent (1977).

DESCRIPTIONS OF TAXA

Lactarius argillaceifolius Hesler & Smith

Figs. 1-7

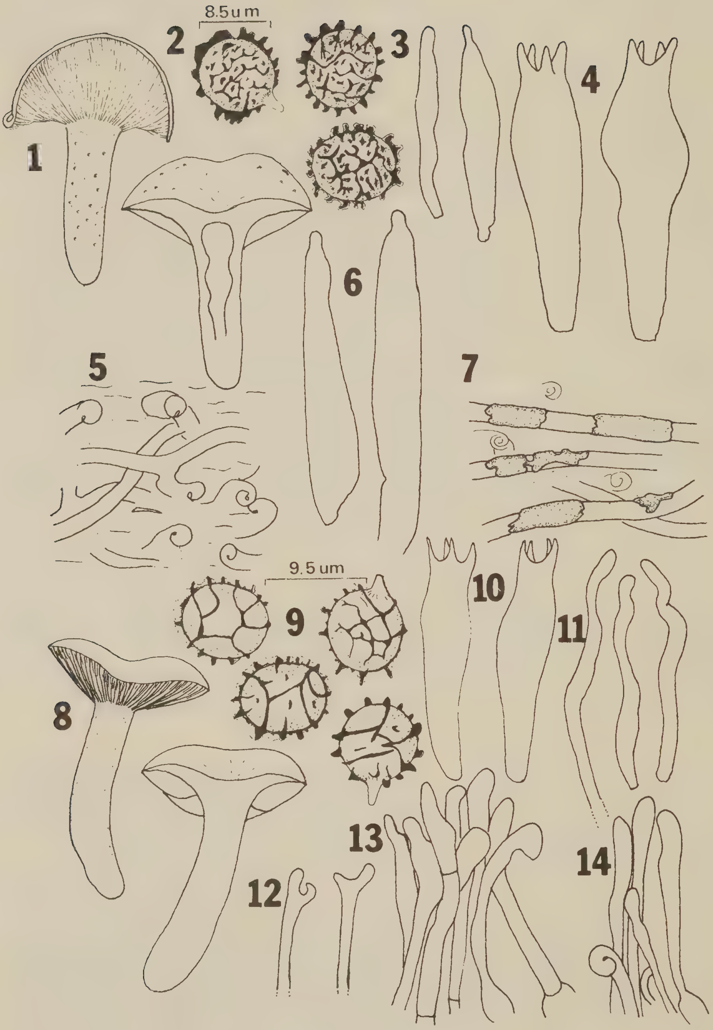
Pileus 5.8-11.2 cm diam, plano-convex to depressed in center, viscid, greyish brown to greyish lilac to gray, some places cream to ochraceous, azonate, sometimes slightly zonate and spotted toward margin, with margin entire. Lamellae adnate to subdecurrent, close to subdistant, thin, white to cream, staining first lilac then brown finally ochraceous (after 15 min.) when injured, edge entire. Stipe 4-7 X 1.7-3 cm, cylindrical to slightly tapering downward, smooth to slightly spotted or subscrobiculate, dry, white to cream, staining lilac-brown, hollow. Context of pileus 0.7-1.2 cm thick, white, staining lilac-violaceous on exposure, odor fragrant. Taste acrid or very slightly acrid in old basidiocarps. Latex white changing to brown, finally ochraceous when dry. Pileus surface yellow to orange with KOH.

Spores cream in deposit, 9.5-12.5 (-13.5) X 8-11 µm, globose to broadly ellipsoid. Ornamentation amyloid forming a subreticulum with isolated spines or warts, prominent 1.5-2 µm high. Basidia 48-56 X 12.5-14.5 µm, claviform, 4-spored, sterigmata 5.5-11 µm long. Pleurocystidia 48-96 X 10-12 µm, fusiform to ventricose, with apex more or less papillate to mucronate. Cheilocystidia 44-72 X 6.5-11 µm, abundant, similar to pleurocystidia. Pileus cuticle a thin ixocutis, hyphae 3-5.5 µm wide, repent-interwoven, embedded in a gelatinous matrix with partial dextrinoid incrustations. Stipe cuticle hyphae 3-7 µm wide, repent-interwoven, some erect, embedded in a refractive matrix, rosettes present, clamp connections absent.

Habit, Habitat and Distribution: Gregarious on ground in Quercus forest, fruiting in September, common in Northeast Mexico and infrequent to common in some areas of southern United States.

Material Studied: MEXICO: Tamaulipas State; Mpio. Victoria, El Madrono, Guevara 593 (ITCV), Garcia 4791, 4795 (ITCV). USA: North Carolina; Guravich 539 (MICH). California; OKM 22762 (VPI).

Observations: This species is difficult to recognize because in some places the basidiocarp becomes lilac-violet at first to brown and then turns ochraceous upon exposure. Our material is similar to L. maculatus Peck in the section Violaceo-Maculati except that it does not have the zonate pileus. It differs from the description in Hesler & Smith (1979) in that it stains violaceous on the basidiocarp.



Figs. 1-7, L. argillaceifolius. 1. basidiocarp x 3/4. 2. spores. 3. pleurocystidia. 4. basidia. 5. pileus cuticle hyphae. 6. cheilocystidia. 7. stipe cuticle hyphae. Figs. 8-14, L. fuliginellus. 8. basidiocarp x 1/2. 9. spores. 10. basidia. 11. cheilocystidia. 12. pseudocystidia. 13. pileus cuticle hyphae. 14. stipe cuticle hyphae.

Lactarius fuliginellus Smith & Hesler Figs. 8-14

Pileus 2.5-10 cm diam, plane to depressed, velvety, dry, with a dark brown slightly paler at the margin, sometimes greyish, with margin undulating and lobed. Lamellae adnate to subdecurrent, subdistant, broad, cream to mustard color, edges even. Stipe 3.3-8 X 0.8-1.3 (-3) cm, cylindrical or slightly tapering downward, velvety, dry, whitish to cream color, whitish in the base, more or less flexible, solid. Context 0.5-1 cm, thick, white changing to pink on exposure, taste mild, odor mild to farinaceous. Latex white unchanging.

Spores cream in deposit, 7-11.5 X 6.5-11 µm, globose to subglobose, with ornamentation strongly amyloid forming a partial reticulum. Basidia 40-70 X 10-12 µm, clavate, 4-spored. Pleurocystidia scarce 25.5-35 X 4-5.5 µm, filiform-sinuous, pseudocystidia present. Cheilocystidia conspicuous and abundant, 28-60 X 4-5 µm, filiform-sinuous, hyaline in KOH. Lactifers abundant within hymenophoral trama. Pileus cuticle basically a trichoderm, end cells (pileocystidia) 20-72 X 5-9 µm, clavate to cylindrical, thick-walled, hyaline to yellow in KOH, yellowish to brown in Melzer's solution. Stipe cuticle a layer of erect hyphae more or less similar to the pileus, caulocystidia 4-6 µm wide, clavate to cylindrical, thick-walled, rosettes (endocystidia) present.

Habit, Habitat and Distribution: Gregarious to solitary under *Quercus* in xerophytic forest or mixed forest, fruiting in September and October, rare in Northeast Mexico, common in Northeast extending southward from the U.S.A. Fruiting in August to October.

Material Studied: MEXICO: Nuevo Leon State; Mpio. de Santiago, El cercado, colonia Los Pescadores, *Guevara 131, 627, 628, 629* (ITCV), *Garcia 4451, 4452, 4512* (ITCV). El Alamo *Garcia 4426* (ITCV). La Camotera, *Ocanas 218* (ITCV). USA: Michigan; *A.H.Smith 81547* (TYPE, MICH).

Observations: The color of the basidiocarp, mild taste, subdistant lamellae, and the context which stains pink on exposure to air are features that distinguish this species. It can be confused with L. fuliginosus Fr. but the latter has an acrid taste. It is also close to L. fumosus Peck but this species has narrow gills and a less robust basidiocarp. In Europe Kuhner and Romagnesi (1953) and Moser (1978) would consider this taxon to be part of the concept of L. fuliginosus Fr. They give priority to spore ornamentation, color of the basidiocarp and the habitat.

Lactarius fumosus Peck Figs. 15-21

Pileus 3.5-5 cm diam, convex, plane to depressed in the center, dry, velvety, greyish brown, with margin entire, incurved and slightly lobed. Lamellae subdecurrent, close, narrow, white to cream color, staining reddish orange when cut, edge entire. Stipe 5-9 X 0.6-1 cm, cylindrical, gradually tapering downward, sometimes curved at the base, dry, velvety, surface concolorous with pileus to slightly creamier, whitish in the base, solid. Context 0.3-0.5 cm thick, white in pileus and stipe changing to vinaceous to orange on exposure to air. Odor mild, taste slightly acrid. Latex white to cream color, unchanging. The context is lilac colored with phenol.

Spores 7-9 (-11) X 7-9 µm, globose to subglobose, ornamentation strongly amyloid forming a partial reticulum, ridges 1.5 µm long. Basidia 40-57 X 8-10.5 µm, claviform, 4-spored, sterigmata 2.5-5.5 µm long. Pleurocystidia and cheilocystidia conspicuous and numerous, 41-60 X 4-10 µm, strangulated to filiform. Pileus cuticle a trichoderm, some sections erect-interwoven, pileocystidia 4-6.5 µm wide, clavate, thin-walled, the subtending cells more or less globose, thick-walled. Stipe cuticle of erect hyphae, 5-6.5 µm wide, claviform. Stipe trama consisting of broad, thick-walled hyphae and rosettes of sphaerocysts. Clamp connections absent.

Habit, Habitat and Distribution: Solitary to subgregarious in mixed hardwood forest or mixed forest under *Liquidambar*, *Magnolia*, *Acer*, and *Quercus*; fruiting in May through August, at 1150 m elevation, infrequent; in Northeast Mexico and Northeast U.S.A.

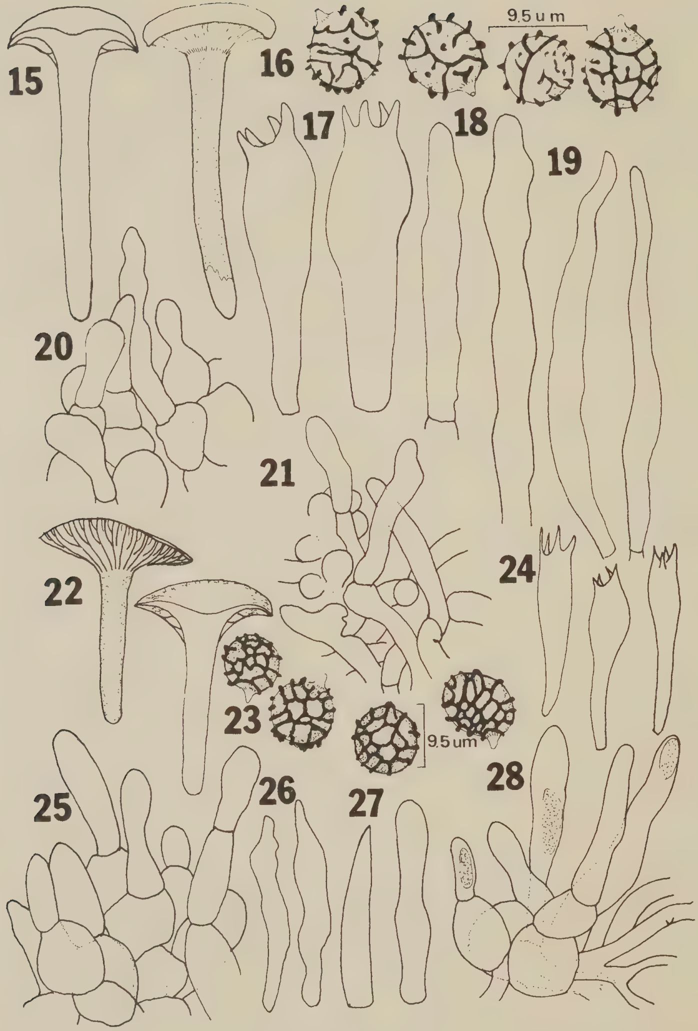
Material Studied. MEXICO: Tamaulipas State; Mpio de Comex Farias, Rancho El Cielo, *Guevara 625*, *695* (ITCV), Durango State; Mpio. de Pueblo Nuevo, El Mil Diez, *Garcia 3466*, *5062* (ITCV). U.S.A.: West Virginia; *G. Bills 445* (VPI).

Observations: This species is recognized by its greyish brown pileus, narrow, close lamellae and the context which changes to a vinaceous color on exposure to air. It is close to *L. fuliginosus* Fr. which differs with broad subsdistant lamellae (Hesler & Smith, 1979).

Lactarius gerardii Peck Figs. 22-28

Pileus 3.5-10.5 cm diam. convex, plano-convex to depressed in the center, velvety, dry, disc dark brown, slightly paler at the margin, margin entire to slightly striate, with veins. Lamellae subdecurrent to decurrent, distant, white to slightly brown toward the stipe, with veins, edge entire. Stipe 6.5-8.2 X 0.8-1 cm, cylindrical to slightly tapering downward, dry, velvety, surface concolorous with pileus to slightly whiter toward base, more or less flexible, apparently hollow. Context 0.5-1 cm thick, white, unchanging, taste mild, odor not noteworthy. Latex white, unchanging.

Spores white in deposit 8-13 X 8-11 µm, globose to subglobose, some broadly ellipsoid, ornamentation forming a reticulum. Basidia 50-64 X 8-12 µm, claviforme, 4-spored, subventricose. Pleurocystidia 28-44 X 2.5-9 µm, claviform to subventricose, scarce, more or less thick-walled. Cheilocystidia 21.5-36 X 3.5-4 µm, cylindrical to


15
16
9.5 u m
17
18
19
20
21
22
23
24
9.5 um
25
26
27
28

Figs. 15-21, L. fumosus. 15. basidiocarp x 1/4. 16. spores. 17. basidia. 18. pleurocystidia. 19. cheilocystidia. 20. pileus cuticle hyphae. 21. stipe cuticle hyphae. Figs. 22-28, L. gerardii. 22. basidiocarp x 1/2. 23. spores. 24. basidia. 25. pileus cuticle hyphae. 26. pleurocystidia. 27. cheilocystidia. 28. stipe cuticle hyphae.

subclaviform or fusiform, abundant, reddish brown in mass, hyaline individually in KOH. Lactifers abundant. Hymenophoral trama of broad hyphae. Pileus cuticle a trichoderm; or with pileocystidia 20-28 X 5.5-9 µm, cylindrical to claviform, reddish brown in KOH, with a cellular base. Stipe cuticle of erect hyphae similar to pileus, caulocystidia 5-6.5 µm, broad, reddish brown in KOH, with globose cells at the base. Clamp connections not present.

Habit, Habitat and Distribution: Solitary to subgregarious under mixed hardwood forests (including _Liquidambar, Magnolia, Acer_ and _Quercus_) fruiting in July, at 960-1150 m, common, in Northeast and Central Mexico and eastern U.S.A.

Material Studied: MEXICO: Tamaulipas State; Mpio. de Gomez Farias, Rancho El Cielo, _Guevara 472, 498, 623_ (ITCV), _Garcia 3901, 3944_ (ITCV). Veracruz State; Mpio. de Atzalan, La Calavera, _Garcia 4860_ (ITCV). USA: Tennessee; _OKM 16167_ (VPI).

Observations: The distinguishing features of this species are the color of the basidiocarp, distant lamellae, mild taste and unchanging context on exposure to air. Our material agrees with Singer (1983) and Hesler & Smith (1979) who described the s species with a mild to slightly acrid taste. This is an edible species according to Burlingham (1910).

Lactarius lignyotellus cf. _texensis_
Smith & Hesler Figs. 29-36

Pileus 2.2-7.8 cm diam, convex, plane, gibbous to slightly umbonate, velvety, dry, dark brown to dark greyish brown, margin lobed and slightly undulating. Lamellae adnate to subdecurrent, subdistant, slightly thick, cream with the edges dark brown, intervenose, edge entire. Stipe 2-8.5 X 0.8-1.3 cm, cylindrical to gradually tapering downward, some curved at the base, dry, velvety, concolorous or with a slightly paler pileus, whitish base, solid. Context 0.6-1 cm thick, white, staining pink toward the stipe on exposure, odor agreeable, taste mild. Latex white, unchanging. Pileus surface becoming dark brown with 3% KOH. FeSO4 negative, context slightly violaceous with phenol.

Spores 8-13 X 8-11 µm, globose to subglobose, subreticulate, amyloid. Basidia 49-66 X 9-12 µm, claviform, 4-spored. Pleurocystidia 40-70 X 10.5-12 µm, claviform to cylindrical, brown in KOH. Cheilocystidia 17-56 X 5.5-10.5 µm, claviform to cylindrical, brown in KOH, pseudocystidia present. Pileus cuticle a trichoderm, 18-51 X 5-11 µm, erect, claviform, constricted, ventricose to cylindrical (versiform), brown in Melzer's solution. Lactifers 10-12 µm wide. Stipe cuticle of erect hyphae, 48-56 X 3-3.5 µm, cylindrical-sinuate to claviform, brown in KOH and Melzer's solution. Clamp connections absent.

Habit, Habit and Distribution: Subgrearious, in mixed forest, under Pinus and Quercus, fruiting in September, rare in Northwest Mexico and Northeast U.S.A.

Material Studied: MEXICO: Durango state; Mpio. de Pueblo Nuevo, KM. 110 carretera Durango-Mazatlan, Guevara 141 (ITCV), El Mil Diez Garcia 4202 (ITCV).

Observations: This member of the Subgenus Plinthogalus is found in southern oak-pine forests but known previously only from Texas. However, the low spore ornamentation and dark brown, umbonate pileus combined with brown gill edges are described by Hesler and Smith (1979). The context in our material changes to pink on exposure to air unlike L. texensis. This contex difference may not prove to be important but we choose, at this time, to refer our material to L. texensis. It is hoped that additional collecting and study of fresh material will help to completely elucidate the characteristics which are necessary to determine if our material can be convincingly separated from L. lignyotellus.

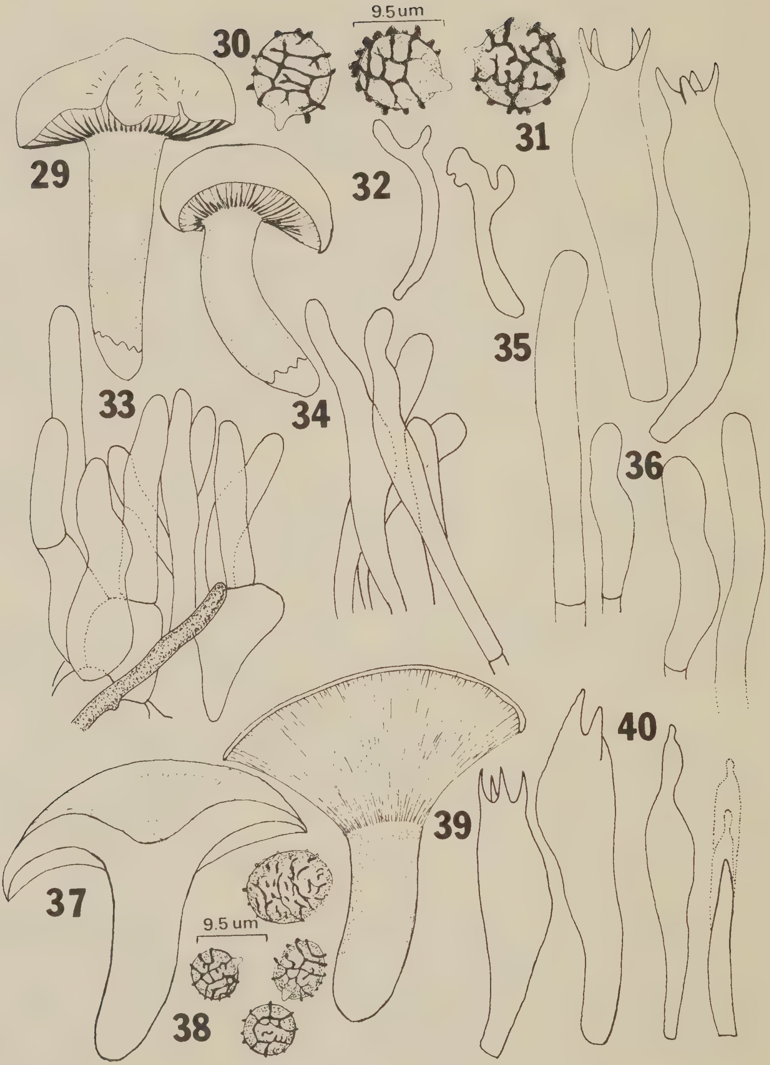
Lactarius olympianus Hesler & Smith Figs. 37-40.

Pileus 7-13 cm diam, depressed in the center, viscid, slightly fibrillose, zonate, yellowish orange to whitish orange with an ochraceous disc, margin involute and entire. Lamellae decurrent, close, narrow (1-3 mm), yellowish cream, sometimes ochraceous in age, fragile, edge entire. Stipe 3.5-4.5 X 1.5-2.2 cm, cylindrical to tapering toward the base, smooth to subscrobiculate, yellowish white with some places staining ochraceous-orange, solid to hollow. Context 0.6-0.7 cm thick, soft, white to cream unchanging. Latex white, unchanging, taste acrid.

Spores cream color in deposit 8-11.5 (-12.5) X 6.5-11 µm (not including ornamentation), subglobose to broadly ellipsoid, ornamentation forming a partial reticulum to subreticulum, ridges 1 µm high, with parts of reticulum isolated. Basidia 39-51 X 10.5-13 µm, claviform, 4-spored, sometimes 2-spored. Pleurocystidia 36-53 X 5.6-6.5 µm, papillate-fusiform to papillate-claviform, pseudocystidia present. Cheilocystidia 32-52 X 5-8 µm, similar to pleurocystidia, sometimes ventricose. Lactifers abundant. Pileus cuticle an ixomixtocutis of hyphae, 2.5-5 µm wide. Stipe cuticle also an ixomixtocutis. Rosettes present in pileus and stipe. Clamp connections absent.

Habit, Habitat and Distribution: Gregarious, on ground in Quercus forest, fruiting in September, rare in Northeast Mexico, common in summer and fall in conifer forest of the Pacific Northwest and Northeast U.S.A.

Material Studied: MEXICO: Tamaulipas State; Mpio. Victoria, El Madrono, Km. 151 carretera Tulo-Victoria, Garcia 4800 (ITCV). Nuevo Leon State; Mpio. de Santiago, Pto. Genovevo, Guevara 134 (ITCV).


30
9.5 um
31
29
32
35
33
34
36
40
39
37
9.5 um
38

Figs. 29-40, L. texensis. 29. basidiocarp x 1/4. 30. spores. 31. basidia. 32. pseudocystidia. 33. pileus cuticle hyphae. 34. stipe cuticle hyphae. 35. pleurocystidia. 36. cheilocystidia. Figs. 37-40, L. olympianus. 37. basidiocarp x 1/4. 38. spores. 39. basidia. 40. pleurocystidia.

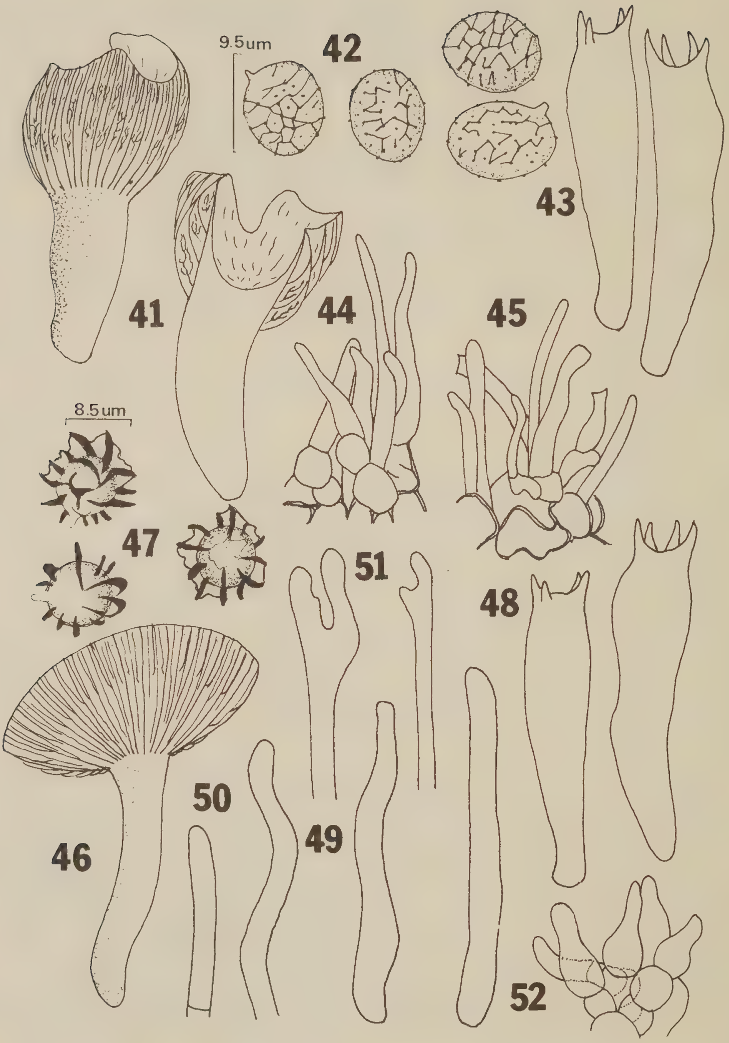
Observations: The distinguishing features of this species are its color, large spores, acrid taste and its zonate pileus. It is very close to L. yazooensis Hes. & Sm. but the latter has smaller spores (7-9 X 6-7.5 µm), and the gills change from pallid to dull vinaceous in age. It is also close to L. zonarius Fr. but the latter has smaller spores, under 10 um long. Our material agrees with Hesler and Smith (1979) except the habitat which they cited as conifer forest. Following Moser (1983) and Burlingham (1910), our material agrees with L. insulsus Fr. from which Hesler and Smith separated L. olympianus.

Lactarius hygrophoroides Berkeley & Curtis
Figs. 41-45.

Pileus 8-13 cm diam, depressed in the center, dry, velvety, some places rugose, yellowish orange, slightly darker in center, margin undulating and lobed. Lamellae subdecurrent to decurrent, thick, distant (3-5 mm), white to cream, with veins, edge entire. Stipe 5.5-9 X 1.7-3 cm, cylindrical, dry, velvety, concolorous with pileus, slightly paler toward base, solid, white mycelium. Context 0.8-1 cm thick, white, odor mild, taste not noteworthy. Latex white, unchanging.

Spores 6.5-11 X 5.5-7 (-9) µm, ellipsoid to subglobose, subreticulated. Basidia 54-67.5 (-72) X 9-11 µm, claviform, 4-spored, sterigmata 2-7 µm long. Pleurocystidia and cheilocystidia not observed. Lactifers 6.5-17 µm thick, vermiform to vesiculose. Pileus cuticle a trichoderm of erect hyphae, 3-5.5 µm wide, cylindrical, truncate, sinuate to gradually tapering toward the apex, with subtending globose cells, 9-27 µm wide. Stipe cuticle of erect hyphae, 2-5.5 µm wide, sinuate-cylindrical to constricted or tapering toward apex, with subtending, globose cells, thick-walled.

Habit, Habitat and Distribution: Solitary, on ground, in mixed hardwood forest, under


9.5um
42
43
41
44
45
8.5um
47
51
48
50
49
46
52

Figs. 41-45, L. hygrophoroides. 41. basidiocarp x 1/4. 42. spores. 43. basidia. 44. stipe cuticle hyphae. 45. pileus cuticle hyphae. Figs. 46-52, L. pterosporus. 46. basidiocarp x 1/4. 47. spores. 48. basidia. 49. pleurocystidia. 50. cheilocystidia. 51. pseudocystidia. 52. pileus cuticle hyphae.

Liquidambar, Magnolia, Acer, and Quercus, fruiting in July, common in Northeast and Central Mexico, U.S.A., Canada, and Asia..

Material Studied: MEXICO: Tamaulipas State; Mpio. Gomez Farias, Rancho El Cielo, Guevara 486 (ITCV). Veracruz State; Mpio. Atzalan, La Calavera, Garcia 4754 (ITCV).

Observations: The distinguishing features of this species are given and illustrated by Miller (1977). Lactarius hygrophoroides Berk. & Curt. was cited by Chacon (1984) from Chiapas State. Our material agrees with Hesler & Smith (1979) and Burlingham (1910). This species is edible according to Miller (1977).

Lactarius cf. pterosporus Romagnesi Figs. 46-52.

Pileus 4.5-6 cm diam, depressed in the center with a small umbo, slightly striate toward disc, wrinkled, dry, velvety, grayish brown to blackish brown, margin entire. Lamellae close becoming distant, decurrent, yellowish cream, intervenose toward pileus margin. Stipe 4.5-5.2 X 0.6-0.8 cm, cylindrical, dry, velvety, paler than ileus, solid to hollow. Context 0.4-0.5 cm thick, pileus and stipe white changing to orange-pink on exposure to air, mild taste, odor indistinct. Latex white, unchanging or slightly pink when dry.

Spores 7-11.5 X 9-11 µm, globose, ornamentation strongly amyloid up to 3.5 µm high. Basidia 44-61 X 11.5-12 µm, claviform, thin to thick-walled. Pleurocystidia 49.5-61 X 2.5-3.5 µm, filiform to filiform-sinuate, thin-walled, pseudocystidia numerous. Cheilocystidia scarce 20-40.5 X 3.5-7 µm, cylindrical to cylindrical-sinuate, thin-walled, lactifers abundant. Pileus cuticle a trichoderm, pileocystidia 4.5-11 µm wide, claviform, strangulate (versiform), thin-walled, context smoky brown in Melzer's solution, the subtending cells more or less globose, thick-walled. Stipe cuticle of erect hyphae, claviform, yellowish in Melzer's solution. Rosettes present.

Habit, Habitat and Distribution: Subgregarious on ground, in mixed hardwood forest under *Liquidambar*, *Magnolia*, *Acer* and *Quercus*, fruiting in October. *Lactarius pterosporus* is common in Europe fruiting under hardwood from July to October.

Material Studied: MEXICO: Tamaulipas State; Mpio. Gomez Farias, Rancho El Cielo, *Guevara 738* (ITCV).

Observations: Fresh material of this taxon from Mexico needs to be studied in detail. It has close affinities to *L. pterosporus* Romag. and we believe it is close to this taxon pending additional study of authentic material of this and other closely related species.

Lactarius piperatus var. *glaucescens*
(Crossl.) Hesler & Smith Figs. 53-58.

Pileus 4-7.5 cm diam, depressed in the center, dry, smooth to rugose, white becoming cream when injured, margin undulating, lobed and entire. Lamellae decurrent, close, narrow, thin, white becoming cream in age, edge entire. Stipe 4-7 X 1.7-2 cm, cylindrical to tapering gradually toward base, smooth, dry, white becoming cream, solid, fragile, white basal mycelium. Context 0.8-0.9 cm thick, white, odor not noteworthy, taste acrid. Latex white changing to olivaceous yellow on exposure to air. Pileus, gills and context become pinkish cherry in $FeSO_4$.

Spores 5.5-8.5 X 5-6.5 µm, broadly ellipsoid, ornamentation forming a partial reticulum of fine ridges united by lines. Basidia 36-40 X 7-9 µm, claviform, somewhat curved in the base, 4-spored. Pleurocystidia absent. Cheilocystidia conspicuous and abundant, 56-72 X 7-9 µm, claviform, in mass, reddish yellow in KOH. Lactifers abundant. Pileus cuticle of more or less erect hyphae, 2.5-4 µm wide, with very wide, subtending cells, 8-32 µm, thick-walled. Stipe cuticle similar to pileus, caulocystidia 2.5-4.5 µm wide, filiform to claviform, solitary or clustered, thin-walled, subtending cells broad and thick-walled.

Habit, Habitat and Distribution: Gregarious on ground in mixed hardwood forest, under Liquidambar, Magnolia, Acer and Quercus, fruiting in May, rare in Northeast Mexico, common in U.S.A., Europe, and Asia.

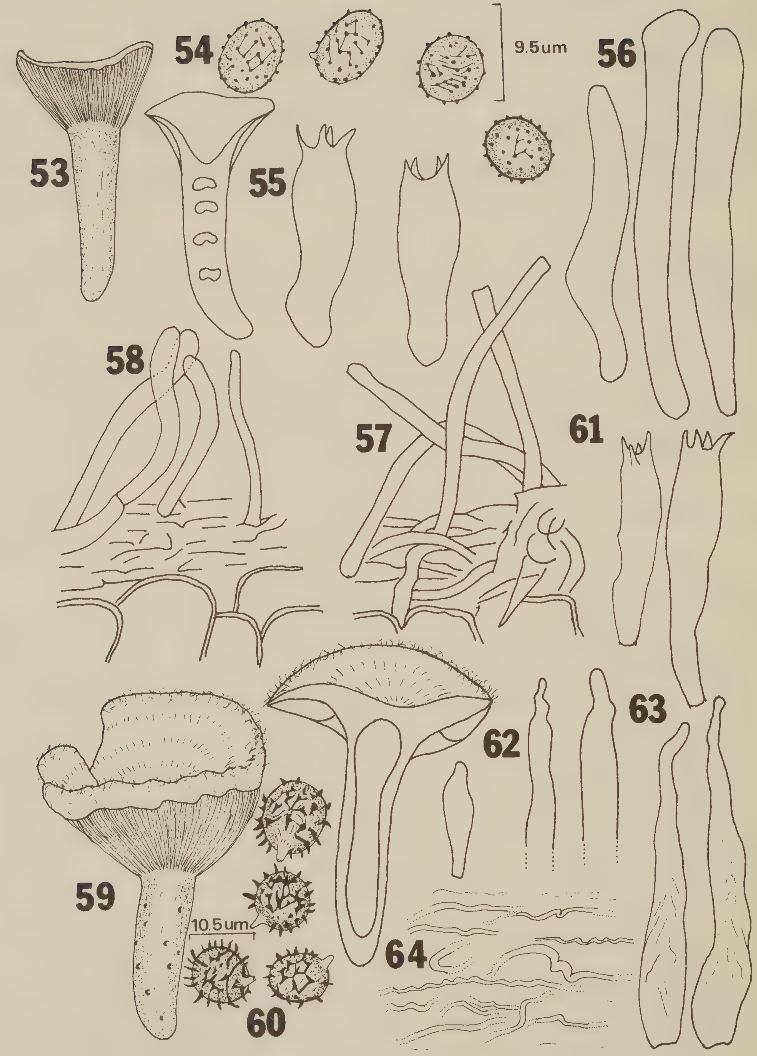
Material Studied. MEXICO: Tamaulipas State; Gomez Farias, Rancho El Cielo, Guevara 626 (ITCV).

Observations: Vaula and Cifuentes (1979) reported L. piperatus from Mexico. The variety glaucescens also has a white latex but it changes to olivaceous yellow on exposure to air.

Lactarius speciosus Burlingham Figs. 59-64.

Pileus 8-12.5 cm diam, depressed in the center, viscid, slightly tomentose beneath the gluten, zonate, ochraceous yellow to greyish brown, some places orange, margin lobed and undulating. Lamellae adnate to subdecurrent, close, thin, yellowish cream, staining reddish brown, margin entire. Stipe 5-6.5 X 1.3-3 cm, cylindrical to gradually tapering toward base, scrobiculate, dry, whitish to ochraceous-brown, hollow. Context 0.7-0.9 cm thick, whitish orange, staining pink to purple or vinaceous on exposure to air in pileus and stipe, taste slightly acrid. Latex pale to cream.

Spores cream yellow in deposit 11-14.5 X 9-12 µm, globose to subglobose or broadly ellipsoid, ornamentation forming a subreticulum, 2.5 µm high, strongly amyloid, with isolated ridges united by fine lines. Basidia 48-60 X 13.5-15 µm, claviform, 4-spored, sterigmata 9-11.5 µm long. Pleurocystidia 40-100 X 9-11 µm, fusiform to papillate-claviform. Cheilocystidia scarce. Pileus cuticle an ixomixtocutis, 1.5-5.5 µm wide. Stipe cuticle not differentiated from context. Stipe trama with rosettes present. Clamp


54
9.5um
56
53
55
58
57
61
63
62
59
10.5um
64
60

Figs. 53-58, *L. piperatus* var. *glaucescens*. 53. basidiocarp x 1/2. 54. spores. 55. basidia. 56. cheilocystidia. 57. pileus cuticle hyphae. 58. stipe cuticle hyphae. Figs. 59-64, *L. speciosus*. 59. basidiocarp x 3/4. 60. spores. 61. basidia. 62. cheilocystidia. 63. pleurocystidia. 64. pileus cuticle hyphae.

connections absent.

Habit, Habitat and Distribution: Gregarious on ground in xerophytic forest under _Quercus_, fruiting in September, uncommon in Northeast Mexico; common in deciduous and mixed woods in summer and early fall in eastern U.S.A.

Material Studied: MEXICO: Nuevo Leon State; Mpio. Santiago, El Cercado, _Garcia_ _4445_ (ITCV).

Observations: This distinctive, zonate _Lactarius_ has a white latex which stains the tissue purple to vinaceous on exposure to air. This is a new record from Mexico but it is widely distributed in south and southeastern United States. No doubt it will be found more often with more intensive field work in the oak forests.

ACKNOWLEDGMENTS

The senior author wishes to thank the Agency for International Development (AID) and COSNET (SEP) in Mexico for financial help and their decision to support my training in the Biology Dept., Virginia Polytechnic Institute and State University. Special thanks to Hope H. Miller for suggestions and editing of the manuscript. Dr. Gaston Guzman (ININEB) in Mexico, Dr. Gerald Bills, Mycology Collections, USDA, and Van Cotter Biology Dept., VPI & SU kindly reviewed the manuscript. Dr. Robert Shaffer sent material from the University of Michigan Herbarium for study.

LITERATURE CITED

Burlingham, G. S. 1910. _Lactarieae_. Pers. N. Amer. Flora 9:172-200.

Castillo, J., J. Garcia, and J. E. San Martin. 1979. Algunos datos sobre la distribucion ecologica de los hongos principalmente los macromicetos en el centro del estado de Nuevo Leon. Bol. Soc. Mes. Mic. 13:229-237.

Chacon, S. and G. Guzman. 1984. Nuevas observaciones sobre los hongos, liquenes y mixomicetos de chiapas. Bol. Soc. Mex. Mic. 19:245-251.

Frutis, I. and G. Guzman. 1983. Contribucion al conocimiento de los hongos de estado de Hidalgo. Bol. Soc. Mex. Mic. 18:219-265.

Garza, F. 1985. Macromicetos asociados al bosque de Quercus rysophylla en algunas localidades del centro de estado de Nuevo Leon. Rev. Mex. Mix. 1:423-437.

Guzman, L. and G. Guzman. 1979. Estudio ecologico comparativo en tre los hongos (macromicetos) de los bosques tropicales y los de coniferas del Sureste de Mexico. Bol. Soc. Mex. Mic. 13:89-126.

Hesler, L. R. and A. H. Smith. 1979. "North American species of Lactarius". The University of Michigan Press, Ann Arbor. 841 p.

Kuhner, R. and H. Romagnesi. 1953. "Flora analytique des champignons superieurs (Agarics, Bolets, Chantarelles)". Masson, Paris, 557 p.

Miller, O. K., Jr. 1977. "Mushrooms of North America". Dutton, New York. 368 p.

Moser, M. 1983. "Keys to Agarics and Boleti". Eng. Ed., Phillips, London. 535 p.

Singer, R. 1957. Fungi mexicani, series prima - Agaricales. Sydowia 11:354-374.

Singer, R. 1973. Diagnoses Fungorum, Novorum Agaricalium III. Beih.

Singer, R., I. Arujo, and M. H. Ivory. 1983. The ectotrophically mycorrhizal fungi of the neotropical lowlands, especially central Amazonia. Beih. Nova Hedwigia 77:1-339.

Varela, L. and J. Cifuentes. 1979. Distribucion de algunos macromicetos en el norte del estado de Hidalgo. Bol. Soc. Mex. Mic. 13:75-88.

MYCOTAXON

Vol. XXX, pp. 177-187 October-December 1987

NOTES ON COELOMYCETES. III. CONCERNING MICROSPHAEROPSIS CONCENTRICA: MORPHOLOGY AND ULTRASTRUCTURE

GARETH MORGAN-JONES

Department of Plant Pathology, College of Agriculture and Alabama
Agricultural Experiment Station, Auburn University, Auburn, Alabama 36849

and

J.F. WHITE, JR.*

Department of Botany, The Ohio State University,
Columbus, Ohio 43210

ABSTRACT

Microsphaeropsis concentrica (Desm.) Morgan-Jones is redescribed from nature and *in vitro*. Problems relating to its classification are discussed and an account of the ultrastructure of its conidiogenous cells and conidia is presented.

INTRODUCTION

As is the case with some other groups of fungi classified within the Coelomycetes, the taxonomy of anamorphic fungi producing pycnidial conidiomata and small, globose to ellipsoid, unicellular, brown conidia is in an unsatisfactory state. Traditionally, many such fungi have been classified under the now conserved generic name *Coniothyrium* Cda (1840) [lectotype species, *C. palmarum* Cda] or '*Coniothyrium* Sacc.', supposedly based on *C. fuckelii* Sacc. In nomenclatural terms, the genus "*Coniothyrium* Sacc." does not actually exist. Petrak and Sydow (1927), who created a concept of *Coniothyrium* around *C. fuckelii*, presented arguments for its maintenance in their sense to preserve common usage and avoid large scale redisposition of taxa considered to be congeneric with that species. Wakefield (1939) advocated conservation of '*Coniothyrium* Sacc.' against *Clisosporium* Fr. and *Coniothyrium* Cda, contrary to the 1935 International Code proposal to conserve *Coniothyrium* Cda emend. Sacc. [type species, *C. diplodiella* (Speg.) Sacc. (≡ *Phoma diplodiella* Speg.)] against earlier homonyms. The latter proposal would have effectively restricted use of the generic name for fungi that are now classified in *Coniella* Höhnel. [*Coniella diplodiella* (Speg.) Petrak & Sydow was considered by Sutton (1980)

---

*Part of the work on which this paper is based was conducted while the junior author was a M.S. student at Auburn University.

Alabama Agricultural Experiment Station Journal Series No. 18-871285

to be possibly an earlier name for *C. fragariae* (Oud.) Sutton, the type species of that genus, but no decision on this could be made because of the inadequate nature of its type material.] In the 1956 International Code, *Coniothyrium* Cda was conserved against *Clisosporium* Fr. [type species, *C. lignorum* Fr.]. Sutton (1971) recognized that *Coniothyrium* Cda cannot be used to accommodate possibly the majority of the species previously classified in it. Differences between the conidiogenous cells and conidia of *C. palmarum* and those of the majority of species classified in the genus, including *C. fuckelii*, particularly the occurrence of successive percurrent proliferation during conidiogenesis and protracted conidium development in the former, has led to the realization that they are not all congeneric (Sutton, 1971, 1980; Morgan-Jones, 1974). The generic name *Microsphaeropsis* Höhnel [type species *M. olivacea* (Bonord.) Höhnel (≡ *Coniothyrium olivaceum* Bonord.)] has been adopted for species possessing enteroblastic conidiogenous cells in which successive conidia secede at the same level. Since over eight hundred taxa have been described under the generic name *Coniothyrium*, extensive revisionary studies will be required before a satisfactory classification of them can be achieved. Sutton (1971, 1974, 1980) and Morgan-Jones (1974) each transferred three species previously classified in *Coniothyrium* to *Microsphaeropsis*. In addition, Sutton (1974) described two new species in *Microsphaeropsis* and Morgan-Jones (1974) one. Sutton (1980) considered the adoption of *Microsphaeropsis* for some former *Coniothyrium* species to be but an interim measure, however, and cautioned against ad hoc transfer of species into it. At least three other generic names, whose type species may be congeneric with *M. olivacea* [*Coniothyriopsis* Speg., *Monoplodia* Westd., and *Phyllostictella* Tassi], and that have date priority over *Microsphaeropsis*, exist in the literature (Sutton, 1977). Two others, *Asteropsis* G. Frag., and *Cryptophaeella* Höhnel, were published in the same year. The final selection of one or other of these possibly available generic names for *Coniothyrium*-like anamorphs having simple phialides must await type studies. Should the type species of *Clisosporium* Fr., *C. lignorum*, be found to have characteristics in common with *M. olivacea*, it would be the earliest name for fungi now classified in *Microsphaeropsis*. Type material of *C. lignorum* cannot, however, be located at Uppsala (Sutton, 1971) and therefore its exact nature remains unknown. In any case, *Clisosporium* Fr. is now a *nomen rejiciendum* for *Coniothyrium* Cda. Its restoration, by removal from the list of *nomina rejicienda*, even if there were good taxonomic grounds for doing so, could not be achieved.

One of the fungi transferred to *Microsphaeropsis*, *M. concentrica* (Desm.) Morgan-Jones, forms the subject of this paper. When the new combination was made, no description of the species was provided although some of its colony characteristics in pure culture were mentioned and colonies on 2% malt agar and conidia were illustrated. It appears to occur commonly on living leaves of *Yucca* species in Europe and North America. Collections made in Alabama and elsewhere, and cultures derived from the former, have offered us an opportunity to redescribe the fungus and conduct studies of its conidial and conidiogenous cell ultrastructure.

It was first described under the name *Phoma concentrica* Desm. and has subsequently had a rather complicated nomenclatural history. Saccardo (1878) classified it in *Coniothyrium* but Höhnel (1918) transferred it to *Dothisphaeropsis* Höhnel [type species, *D. hellebori* Höhnel] because of the nature of its conidiomata. Several other binomials, including *Coniothyrium yuccae* Speg., may also have been applied to it, but examination of type

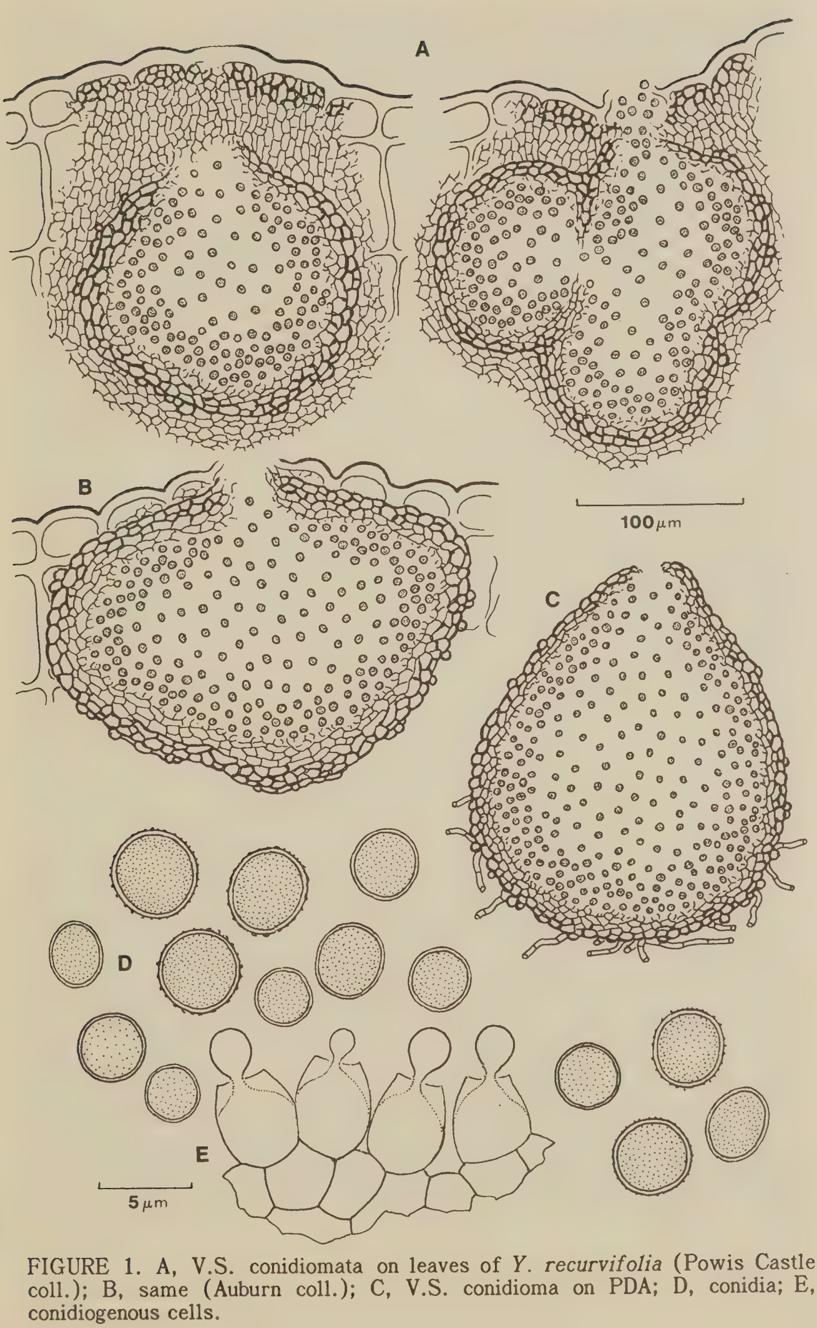


FIGURE 1. A, V.S. conidiomata on leaves of *Y. recurvifolia* (Powis Castle coll.); B, same (Auburn coll.); C, V.S. conidioma on PDA; D, conidia; E, conidiogenous cells.

specimens will be required to confirm this. Archer (1926), who provided a description and illustration of *M. concentrica* [as *C. concentricum*], documented over ten facultative synonyms. It is doubtful, however, that all of the names listed by him were, in reality, based on this fungus.

MATERIALS AND METHODS

Microsphaeropsis concentrica was isolated from conidial masses exuding from conidiomata in necrotic lesions on leaves of *Yucca filamentosa* (Ozark, Dale Co., Alabama collection). A number of single-conidium subisolates were prepared following conidiation on malt extract agar [Difco]. Colony characteristics and radial growth rates were determined on potato dextrose agar [Difco] and malt extract agar incubated at three temperatures (20, 25 and 30C) in the dark. Four replicate plates, each inoculated with a single 5-mm-diameter agar disk cut from the edge of an actively growing 14-day-old colony on PDA, per treatment were used. Measurement of conidiomatal and conidial dimensions were made both from the host and *in vitro*.

For light microscopy, host tissue bearing conidiomata and conidiomata on agar were fixed in FAA, dehydrated into absolute ethanol and embedded in LR White® (hard) acrylic embedding medium. Vertical sections were obtained using a Sorvall® MT-2 "Porter Blum" ultramicrotome and stained in toluidine blue before mounting. For transmission electron microscopy conidiomata were removed from agar cultures, cut in half using a razor blade, and embedded in water agar. Small agar blocks containing conidiomatal halves were then fixed for two hours in 2% glutaraldehyde, followed by a rinse in cacodylate buffer and post-fixed for seven hours in 1% osmium tetroxide. The material was dehydrated through a graded ethanol series and infiltrated in three steps of 30, 60 and 100% LR White® (hard) embedding medium with ethanol as a solvent. The material was submitted to the first two steps for three hours each and the final step for seven days. Sections were obtained by the same instrument as used for light microscopy, stained in 1% uranyl acetate, and examined using a Phillips transmission electron microscope (model 300, D701). For scanning electron microscopy, specimens were fixed, dehydrated, coated with gold and palladium using a Denton DV-502 vacuum evaporator, and examined using a Phillips AMR (Model 1000) scanning electron microscope.

TAXONOMIC PART

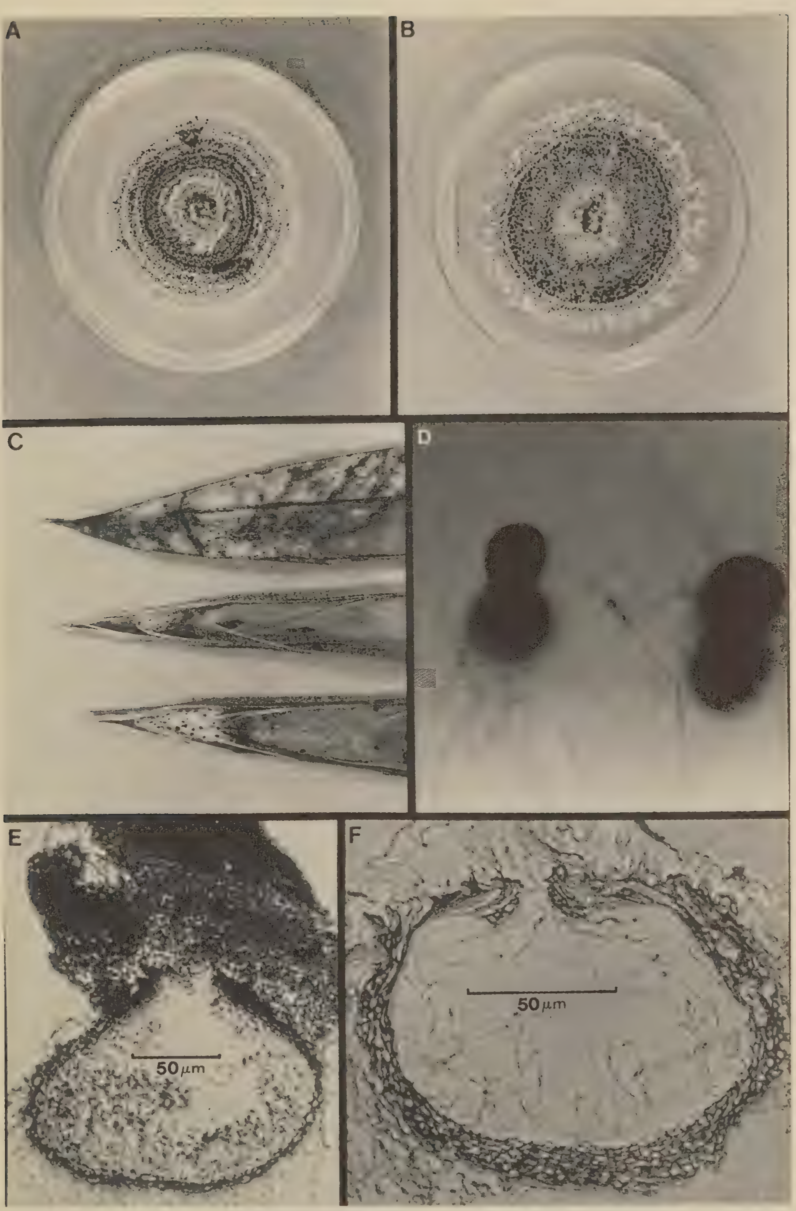
Microsphaeropsis concentrica (Desm.) Morgan-Jones, *Can. J. Bot.* 52: 2578, 1974 (Plates 1 and 2, Figure 1).

≡ *Phoma concentrica* Desm., *Ann. Sci. nat.* 13: 189, 1840.

≡ *Coniothyrium concentricum* (Desm.) Sacc., *Michelia* 1: 204, 1878.

≡ *Dothisphaeropsis concentrica* (Desm.) Höhnel, *Ber. dtsch. Bot. Ges.* 6: 315, 1918.

PLATE 1. *Microsphaeropsis concentrica*. A, 7-day-old colony on PDA; B, same on MEA; C, lesions on leaves of *Yucca filamentosa* D, conidiomata bearing conidial masses on PDA; E, V.S. conidioma on PDA; F, V.S. conidioma on *Y. filamentosa* leaf.


A
B
C
D
E
50 μm
F
50 μm

Lesions of various sizes, orbicular or completely occupying extended area behind the sharply acute leaf tip, amphigenous, whitish to buff grayish when older, with a narrow brown to dark brown margin where bordering healthy leaf tissue, bearing scattered to gregarious, frequently concentrically arranged, epiphyllous, black, immersed conidiomata. Colonies on PDA at first whitish to cream colored, lanose, sometimes becoming mottled with pale sage green to salmony patches, attaining a diameter of 31 mm at 20C, 40 mm at 25C and 34 mm at 30C after seven days, producing numerous black, pycnidial conidiomata arranged in concentric rings; reverse concolorous. Colonies on MEA cream-colored, lanose, often somewhat sparse, bearing less aerial mycelium than on PDA, with hyphae at periphery of a 14-day-old colony often having a tufted appearance, attaining a diameter of 31 mm at 20C, 42 mm at 25C and 37 mm at 30C, producing abundant conidiomata whose exuding, blackish, conidial masses frequently become confluent; reverse concolorous. Mycelium immersed in host tissue, composed of septate, branched, subhyaline to pale brown, smooth, 1.5-3 µm wide hyphae. Conidiomata in host plants having the form of solitary, one-ventered pycnidia without extra-pycnidial stromatic tissue, or, more often, surrounded singly or in confluent groups of a few by such tissue, subglobose, brown to blackish brown, pseudoparenchymatous, 150-300 µm in diameter, with no necks and ill-defined ostioles. Where enveloped by stromatic cells, pycnidial wall usually discernible by tissue texture. Stromatic tissue variously developed from rudimentary to extensive. Conidiomatal wall thick, composed of an outer layer of more or less isodiametric or slightly elongate, thick-walled, 4-10 µm in diameter, brown cells of textura angularis, and an inner layer of smaller, thinner-walled cells lining the venter. In culture, conidiomata pycnidial, appreciably narrower-walled than in nature with no stromatic tissue developed. Conidiogenous cells phialidic [*sensu* Sutton (1980)], discrete, subglobose to irregularly ampulliform, hyaline, periclinal thickening substantial, formed from inner cells of conidiomatal wall, 3-5 X 4-5 µm. Conidia subglobose to globose, pale to mid brown, thick-walled, verruculose, aseptate, 3-5.5 X 3-4.5 µm.

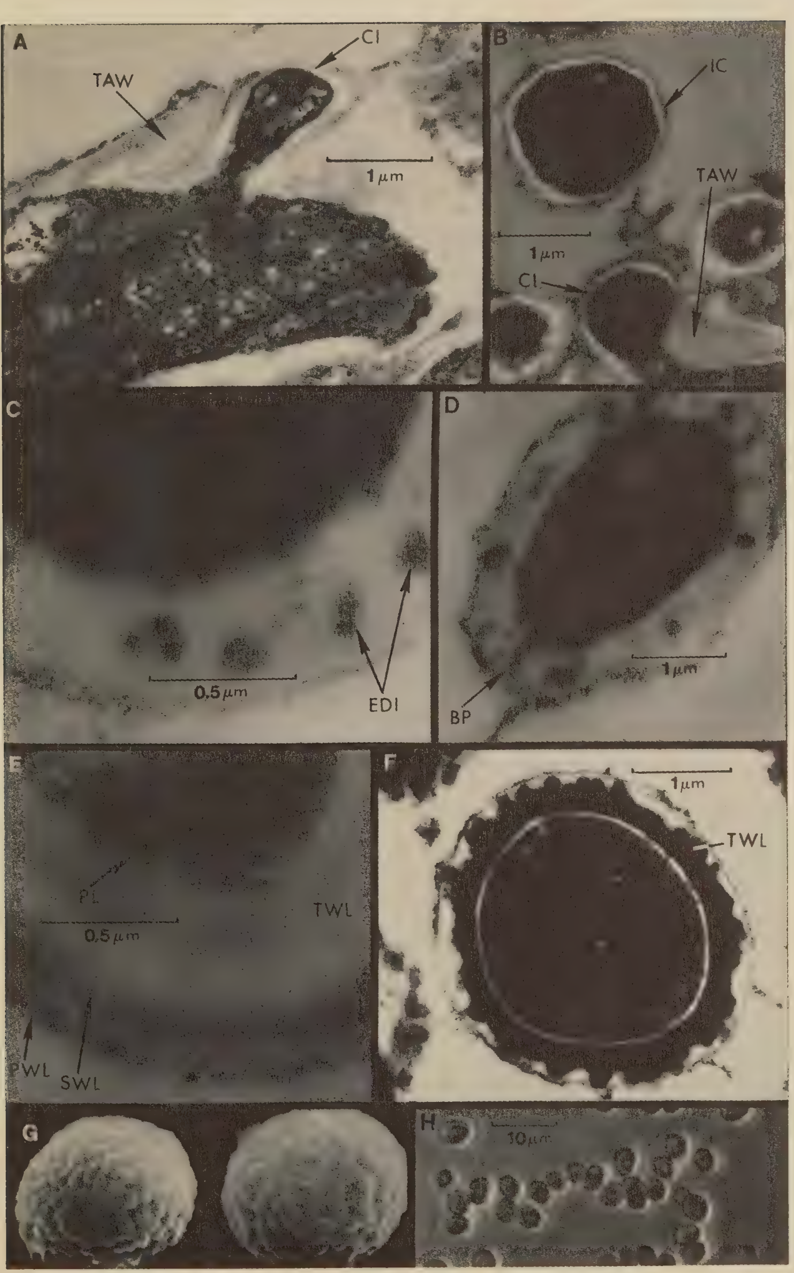
On leaves of *Yucca* spp.; Europe and North America.

Collections examined: on *Y. gloriosa* L., Kings Lynn, Norfolk, United Kingdom, 1877, B. Plowright, K; on *Y. gloriosa*, Selva, Treviso, Italy, Autumn 1894, P.A. Saccardo, K; on *Y. recurvifolia* L., Powis Castle, Welshpool, Wales, United Kingdom, August 8, 1962, G. Morgan-Jones, IMI 107956; on *Y. recurvifolia*, Oxford Co., Ontario, Canada, November 18, 1971, G. Morgan-Jones, AUA; on *Y. filamentosa* L., Ozark, Dale Co., Alabama, U.S.A., June 10, 1982, J.F. White Jr., AUA; on *Y. recurvifolia*, Auburn, Lee Co., Alabama, U.S.A., July 19, 1982, J.F. White Jr., AUA.

CONIDIOGENESIS AND CONIDIUM ULTRASTRUCTURE

Transmission electron micrographs of thin sections of conidiogenous cells and developing conidia (Plate 2, A and B) reveal a very thickened periclinal wall

PLATE 2. *Microsphaeropsis concentrica*. A, TEM of conidiogenous cell (thin section), [TAW = thickened apical wall, CI = conidium initial]; B, TEM of conidiogenous cell apex and young conidium [IC]; C,D & E, TEM of maturing conidial walls (thin sections) [EDI = electron dense inclusions, BP = basal pore, PL = plasmalemma (with invaginations), PWL = primary wall layer, SWL = secondary wall layer, TWL = tertiary wall layer]; F, TEM of mature conidium; G, SEM of conidial surface; H, conidia (phase contrast, light microscopy).


A
CI
TAW
1 µm
B
IC
TAW
1 µm
CI
C
0.5 µm
EDI
D
1 µm
BP
E
PL
TWL
0.5 µm
PWL
SWL
F
1 µm
TWL
G
H
10 µm

toward the apex. The thickened area is noticeably striated longitudinally, each striation representing remnant wall material deposited in the process of differentiation of successive conidia. The structure of the conidiogenous cell and pattern of conidiogenesis are essentially similar to those documented to occur in species of *Phoma* Sacc. by Brewer and Boerema (1965) and Boerema and Bollen (1975) and in *Coniothyrium fuckelii*, *Microsphaeropsis olivacea* [as *olivaceum*] and *Phoma pomorum* Thüm., by Jones (1976). A thin, primary conidial wall layer is first produced within the conidiogenous cell, extending down the length of the thickened apical wall area. After the conidium initial emerges beyond the conidiogenous cell apex and inflates, a secondary wall layer is deposited endogenously. This layer invaginates in proximity to the conidiogenous cell apex, forming a septum. The conidium secedes following a schizolytic break at the septum, leaving a 'half septum' at the apex of the conidiogenous cell which becomes part of the primary wall layer of the succeeding conidium. At about the time of conidium detachment, a thick, electron transparent wall layer begins forming beneath the two preexisting wall layers (Plate 2, E). At this stage, the conidium is far from being fully differentiated and mature. Under the light microscope, conidia, when first detached, appear thin-walled and subhyaline, becoming progressively pale brown and thicker walled when free within the conidiomal venter. At one time, conidia at various stages of maturation can be found detached within a single conidioma. Within the thick tertiary wall layer a number of discrete, spot-like, electron dense inclusions soon appear at regular intervals around the conidium (Plate 2, C) and a cylindrical, basal pore is apparent (Plate 2, D). As more electron dense spots are formed they coalesce, become even denser, and eventually differentiate into a discrete layer whose outer surface is highly undulate and inner surface is smooth and even. Between the inner surface and the plasma membrane a narrow electron transparent band remains. (Plate 2, F). Conidia enlarge during this process and the primary and secondary wall layers are sloughed off leaving a distinctly verruculose surface (Plate 2, G).

DISCUSSION

Microsphaeropsis concentrica is, in all likelihood, cosmopolitan in distribution. Grove (1937) records it from India and Sri Lanka [as Ceylon] as well as from Europe and the U.S.A. It has been collected on *Yucca macrocarpa* Engelm., in New Mexico (Archer, 1926). There are also records of what was believed to be the same fungus on other host genera belonging to the Liliaceae, including *Agave* L., *Dasylirion* Zucc., and *Dracaena* Vand., and on *Furcraea* Vent. [as *Fourcroya* Spreng.], a member of the Amaryllideae (Saccardo, 1884; Saccardo and Sydow, 1897; Grove, 1937). Names such as *Coniothyrium concentricum* var. *agaves* Sacc., *C. dasylirii* Celotti, and *C. dasylirii* Speg. could, on the basis of published conidial dimensions, refer to this fungus. *Coniothyrina agaves* (Dur. & Mont.) Petrak & Sydow [≡ *Phoma agaves* Dur. & Mont., ≡ *Coniothyrium agaves* (Dur. & Mont.) Sacc.], the type species of *Coniothyrina* Sydow [= *Coniothyrella* Speg. (1910), non *Coniothyrella* Speg. (1889)], based on a collection on *Agave americana* L. made in Algeria, appears to be different.

A number of species of *Coniothyrium* auct. are known to be anamorphs of *Paraphaeosphaeria* O. Eriksson. For example, *C. castagnei* (Fckl) Sacc. is the anamorph of *P. castagnei* (Dur. & Mont.) O. Eriksson (Shoemaker and Babcock, 1985), and *C. scirpi* Trail [= *C. zeae* Stout] is the anamorph of *P. michotii* (Westd.) O. Eriksson (Webster, 1955). A *Coniothyrium* anamorph was also reported for *P. glauco-punctata* (Grev.) Shoemaker & Babcock by Müller and Tomaševič (1957). *Paraphaeosphaeria obtusispora* (Speg.) O. Eriksson [≡ *Leptosphaeria obtusispora* Speg.], a species described on *Yucca gloriosa* L. by Spegazzini (1881), has also been reported to occur on *Agave*, *Aloë* L., *Dracaena* and *Fourcroya* (Hedjaroude, 1968). It seems possible that this might be the teleomorph of *M. concentrica*. Sivanesan (1984), however, cites *Coniothyrium henriquesii* Thüm, as the anamorph of *P. obtusispora*.

In the process of segregating genera such as *Dothisphaeropsis* and *Microsphaeropsis* from *Coniothyrium*, and their subsequent characterization, some attention was paid to the morphology of conidiogenous cells as well as conidiomatal structure. Höhnel (1919) stated that *Dothisphaeropsis* [teleomorph, *Haplotheciella* Höhnel] differed from *Microsphaeropsis* by having pycnidia-like locules fused to the outer wall of the epidermis, with brown hyphae and a vaguely indicated stroma. The conidiophores were said to be barely visible. Petrak (1923), in a key to nine genera, noted a number of differences between *Dothisphaeropsis* and *Microsphaeropsis*. The former was described as having small pycnidia completely developed in the epidermis, composed of a thick membrane and formed like a stroma from numerous long, brown, thin-walled cells, bearing papilla-shaped conidiophores. Frequently only one, and rarely more, locules were found to be present. *Microsphaeropsis* was considered to mostly consist of saprophytic forms on herbaceous stems and branches. It reportedly had a vaguely indicated intramatrical stroma developed as loose hyphal tissue between closely heaped pycnidia, or rarely composed of parenchymatic tissue of small cells. Pycnidia were described as being more or less extensively distributed, scattered or gregarious, and short conical or papilla-like toward the ostiole. The pycnidial wall was noted to be made up of parenchymatic cells, often in two distinctly separate layers, bearing rod-shaped conidiophores. Petrak and Sydow (1927) considered the type species of *Dothisphaeropsis* to belong in *Coniothyrium* Sacc. and the name *C. hellebori* Cke & Mass. was used for it. Wollenweber and Hochapfel (1937) concurred with this view. Sutton (1977) listed *Dothisphaeropsis* as a synonym of *Microsphaeropsis*.

Generic concepts, as well as matters nomenclatural, in this group of fungi currently need clarification. It is unclear whether or not the presence or absence of stromatic tissue associated with conidiomata and conidiomal wall anatomy has significance in defining genera. Species of *Microsphaeropsis* such as *M. conielloides* Sutton and *M. pseudaspera* Sutton have quite thick-walled pycnidia that are similar in cellular composition to those of *M. concentrica*. Other species, including *M. olivacea*, have narrower pycnidial walls.

Conidial wall ultrastructure may have some use as a taxonomic criterion in the *Coniothyrium/Microsphaeropsis* complex although much more information is required before a judgement on this can be made. Jones and Johnson (1970), by freeze-etching technique and examination of thin sections of conidial walls with an electron microscope, showed that in *Coniothyrium minitans* Campb. (which is probably congeneric with the species currently classified in *Microsphaeropsis*) a similar complexity occurs to that described for *M. concentrica* in this paper. The conidia were found to have an outer granular layer with large protuberances giving the surface a verrucose appearance, a fibrillar middle layer and possibly a thin amorphous inner layer. The plasmalemma had variously sized invaginations, a condition also seen by us in *M.*

concentrica (Plate 2, E). Punithalingam and Jones (1970), in electron micrographs of carbon replicas of conidia of *C. minitans*, *M. sarcinellae* (Sahni) Morgan-Jones [as *C. sarcinellae*] and an unnamed species of *Coniothyrium*, showed these to have an uneven surface with variation in ornamentation in the form of protuberances of various sizes. *Coniothyrium fuckelii* was found to have an entirely smooth surface. Jones (1976) showed conidia of *Microsphaeropsis olivacea* to also have a complex wall. This was shown to consist of a narrow outer zone which is composed of a slightly electron-dense peripheral layer, a thin electron-opaque middle layer, and a thicker electron-dense inner layer, surrounding a wide, homogenous, electron-transparent zone. An exterior, unevenly-thickened, electron-transparent layer was found separating the conidium from the pycnidial matrix. A micrograph of a thin section through a mature conidium of *Coniothyrium fuckelii* showed its wall to be composed of a narrow electron-dense outer layer and a wide electron-transparent inner layer.

ACKNOWLEDGMENTS

We thank Dr. Brian C. Sutton, CAB International Mycological Institute, Kew, Surrey, United Kingdom, for his advice on several matters taxonomic and nomenclatural. Both he and Dr. Mary E. Palm, Animal and Plant Health Inspection Service, USDA, Beltsville, Maryland, reviewed the manuscript and offered helpful suggestions.

LITERATURE CITED

ARCHER, W.A. 1926. Morphological characters of some Sphaeropsidales in culture. *Ann. mycol.* 24: 1-84.

BOEREMA, G.H. and G.J. BOLLEN. 1975. Conidiogenesis and conidial septation as differentiating criteria between *Phoma* and *Ascochyta*. *Persoonia* 8: 111-144.

BREWER, J.G. and G.H. BOEREMA. 1965. Electron microscope observations on the development of pycnidiospores in *Phoma* and *Ascochyta* spp. *Proc. K. Ned. Akad. Wet.* (C) 68: 86-97.

GROVE, W.B. 1937. British Stem- and Leaf-Fungi (Coelomycetes) II. Cambridge Univ. Press. 406 pp.

HEDJAROUDE, G.A. 1968. Études taxonomiques sur les *Phaeosphaeria* Miyake et leurs formes voisines (Ascomycetes). *Sydowia* 22: 57-107.

HÖHNEL, F. von. 1918. Fungi imperfecti. Beiträge zur Kenntnis derselben. *Hedwigia* 60: 129-209.

HÖHNEL, F. von. 1919. Fragmente zur Mykologie XXIII. *Sber. Akad. Wiss. Wein.* 128: 1-91.

JONES, D. and R.P.C. JOHNSON. 1970. Ultrastructure of frozen, fractured and etched pycnidiospores of *Coniothyrium minitans*. *Trans Br. mycol. Soc.* 55: 83-87.

JONES, J.P. 1976. Ultrastructure of conidium ontogeny in *Phoma pomorum*, *Microsphaeropsis olivaceum* and *Coniothyrium fuckelii*. *Can. J. Bot.* 54: 831-851.

MORGAN-JONES, G. 1974. Concerning some species of *Microsphaeropsis*. *Can. J. Bot.* 52: 2575-2579.

MÜLLER, E. and M. TOMAŠEVIČ. 1957. Kulturversuche mit einigen Arten der gattung *Leptosphaeria* Ces. & DeNot. *Phytopathol. Z.* 29: 287-294.

PETRAK, F. 1923. Mycologische Notizen. V. *Ann. mycol.* 21: 1-69.

PETRAK, F. and H. SYDOW. 1927. Die Gattungen der Pyrenomyzeten, Sphaeropsideen und Melanconieen. *Beih. Rep. spec. nov. regni veg.* 42: 1-551.

PUNITHALINGAM, E. and D. JONES. 1970. Spore surface ornamentation in *Coniothyrium* species. *Trans. Br. mycol. Soc.* 55: 154-156.

SACCARDO, P.A. 1878. Fungi veneti novi vel critici vel mycologiae venetae, addendi, Series VII. *Michelia* 1: 133-221.

SACCARDO, P.A. 1884. *Syll. fung.* 3: 1-860.

SACCARDO, P.A. and P. SYDOW. 1897. *Syll. fung.* 12: 1-1053.

SHOEMAKER, R.A. and C.E. BABCOCK. 1985. Canadian and some extralimital *Paraphaeosphaeria* species. *Can. J. Bot.* 63: 1284-1291.

SIVANESAN, A. 1984. The bitunicate Ascomycetes and their anamorphs. Cramer, Vaduz.

SPEGAZZINI, C. 1881. Fungi Argentini additis nonnullis Brasiliensibus Montevideensibusque. Pugillus IV. *An. Soc. Cient. Arg.* 12: 174-189.

SUTTON, B.C. 1971. Coelomycetes. IV. The genus *Harknessia* and similar fungi on *Eucalyptus*. *Mycol. Pap.* 123: 1-46.

SUTTON, B.C. 1974. Miscellaneous coelomycetes on *Eucalyptus*. *Nova Hedwigia* 25: 161-172.

SUTTON, B.C. 1977. Coelomycetes VI. Nomenclature of generic names proposed for Coelomycetes. *Mycol. Pap.* 141: 1-253.

SUTTON, B.C. 1980. The Coelomycetes. Commonwealth Mycological Institute. 696 pp.

WAKEFIELD, E.M. 1939. Nomina generica conservanda. Contributions from the nomenclature committee of the British Mycological Society II. *Trans. Br. mycol. Soc.* 23: 281-292.

WEBSTER, J. 1955. Graminicolous Pyrenomycetes. V. Conidial states of *Leptosphaeria michotii*, *L. microscopica*, *Pleospora vagans* and the perfect state of *Dinemasporium graminum*. *Trans Br. mycol. Soc.* 38: 347-365.

WOLLENWEBER, H.W. and H. HOCHAPFEL. 1937. Beiträge zur Kenntnis parasitärer und saprophytischer Pilze IV. *Z. f. Parasit.* 9: 600-637.

MYCOTAXON

Vol. XXX, pp. 189-192 October-December 1987

XEROMEDULLA, A NEW GENUS OF FOLIICOLOUS DISCOMYCETES (LEOTIACEAE)

WEN-YING ZHUANG AND RICHARD P. KORF

Plant Pathology Herbarium, Cornell University
Ithaca, NY 14853 USA

ABSTRACT: A new genus, *Xeromedulla*, is described. Two new, foliicolous species from the Philippines, *X. leptospora* and *X. tomentulosa,* are included.

Several collections from Southeast Asia to be issued in Korf & Gruff, Discomycetes Exsiccati have been examined. Amongst these, two new species have been found. One grows on leaf blades of a burseraceous plant, the other, known from two collections, on leaf blades of an unidentified plant. These species are so distinct from any fungi of existing genera of the Leotiaceae that we describe them under a new genus.

XEROMEDULLA Korf & Zhuang, **gen. nov.**

Apothecium parvum, discoideum vel planum, stipitatum, pallidum, receptaculi stipitisque superficie projecturis hyphalibus brevibus hyalinis granulatis induta; stipes ex textura oblita compositus; excipulum ectal ex texatura angulari gelatinosa compositum, cellularum parietibus crassis vitreis; excipulum medullosum ex textura intricata compositum; asci inoperculati, subcylindrici vel clavati, 8-spori, pori parientibus in "Melzer's Reagent" colorem caeruleum ducentibus ubi in KOH aquoso prius tractatis; ascospori hyalini nonseptati; paraphyses filiformes apicibus obtusis vel acutis. In foliorum laminis inventa.

Typus: Xeromedulla leptospora.

Apothecium small, discoid to flat, stipitate, hymenium light in color when dry, white when rehydrated, stipe and receptacle white, receptacle surface smooth, minutely downy, or slightly tomentose. Hyphal protrusions short, hyaline, thin-walled, granulate, usually unicellular. Stipe covered with short hyphal protrusions, of textura oblita, hyphae glassy-walled, axes of hyphae in the outer layers towards outside at a small angle to axis of stipe, hyphae in the inner layers parallel to axis of stipe. Ectal excipulum of gelatinized textura angularis, cells hyaline, cell walls very thick and strongly glassy; medullary excipulum of textura intricata, nongelatinized, hyphae hyaline, walls thin to very thick, glassy. Asci inoperculate, subcylindrical to clavate, 8-spored, ascus pore J+ in Melzer's Reagent with KOH pretreatment. Ascospores nonseptate, hyaline, variable in shape. Paraphyses filiform with blunt or pointed apex. On leaf blades.

Type: *Xeromedulla leptospora.*

1. **Xeromedulla leptospora** Zhuang & Korf, **sp. nov.** (Fig. 1)

Apothecium planum vel tenue discoideum ubi siccum, convexum, ad 0.6 mm in diam. ubi aqua refertum, stipitatum, 0.5 mm altum, hymenio flavo, receptaculo exalbido, laevi vel minute pubenti ubi sicco; projecturae hyphales parietibus tenuibus praeditae, parum undulatae, 5-13(-22) μm longae; excipulum ectale ex textura angulari compositum, cellularum parietibus gelatinosis crassis vitreis; excipulum medullosum ex textura intricata compositum, parietibus hyphalibus crassis vitreis; asci subcylindrici, 8-spori, pori parietibus in "Melzer's Reagent" colorem dilute caeruleum ducentibus ubi in KOH aquoso prius tractatis vel non tractatis, ca. 45-50 x 3.5-4.0 μm; ascospori filiformes, 39-48 x 0.4-0.5 μm, paraphysium apicibus acutae. In plantae burseraceae foliis inventa.

Apothecium flat to shallow discoid when dry, convex, semitranslucent, and up to 0.6 mm in diam when rehydrated, stipitate, ca. 0.5 mm high, hymenium yellow and receptacle surface whitish, smooth to minutely downy when dry. Hyphal protrusions very short, hyaline, unicellular, granulate, thin-walled, slightly undulate, 5-13(-22) μm long. Ectal excipulum of textura angularis, cell walls gelatinized, very thick, and glassy; medullary excipulum of textura intricata, nongelatinized, hyphae loosely interwoven, 4.3-7.5 μm wide, very thick- and glassy-walled. Asci subcylindrical, 8-spored, pore tiny, J+, pore walls faintly blue in Melzer's Reagent with or without KOH pretreatment, about 45-50 X 3.5-4.0 μm. Ascospores filiform, nonseptate, 39-48 X 0.4-0.5 μm. Paraphyses filiform, less than 1.5 μm wide, with pointed apex, exceeding asci ca. 4 μm.

Habitat: on leaf blades of a burseraceous plant, "Sahing" in Tagalog (possibly *Canarium* sp. or *Santiria* sp., identified by Mr. E. Cope).

Holotype: on leaf blades of a burseraceous plant, "Go-Go Hill," Mt. Bonahao from the Sariaya side, Luzon, Philippines, K. P. Dumont, P. Zamora, B. Hernaeiz, 14. VI. 1966, CUP-SA 952 (a few leaves with *X. tomentulosa* were mixed in, and have been segregated as CUP-SA 3305). Isotypes will be issued in Korf & Gruff, Discomycetes Exsiccati.

2. **Xeromedulla tomentulosa** Zhuang & Korf, **sp. nov.** (Fig. 2)

Ab X. leptospora projecturis hyphalibus multo longioribus, ascis clavatis et brevibus, ascosporis subellipsoideis vel subfusoideis, paraphysium apicibus obtusis non acutis differens.

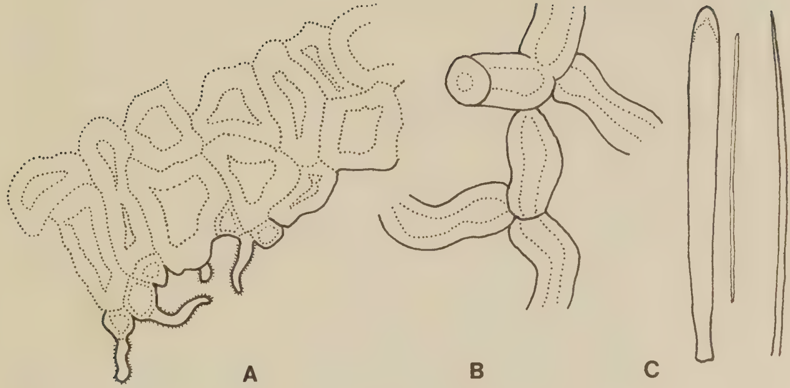


Fig. 1. *Xeromedulla leptospora* (holotype): A. ectal excipulum with short, granulate hyphal protrusions, B. thick-walled medullary hyphae, C. an ascus, an ascospore (left) and a paraphysis (right). All X 1000.

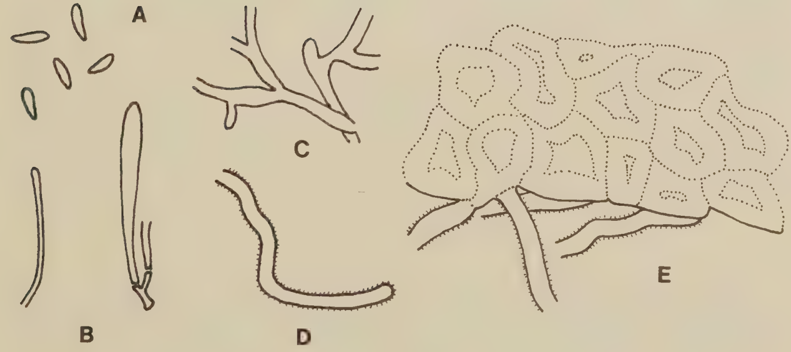


Fig. 2. *Xeromedulla tomentulosa* (paratype): A. ascospores, B. an ascus arising from crozier and a paraphysis, C. thin-walled medullary hyphae, D. a granulate hair, E. ectal excipulum. All X 1000.

Apothecium discoid, semitranslucent, ca. 0.6 mm in diam when rehydrated, stipitate, ca. 0.5 mm high, hymenium light yellow to yellow when dry and faintly yellow when rehydrated, receptacle and stipe white when dry, receptacle surface tomentose, sometimes in patches. Hairs hyaline, cylindrical, nonseptate, granulate, thin-walled, slightly undulate, 15-35 µm long. Ectal excipulum of textura angularis, cell walls gelatinized, very thick, and glassy; medullary excipulum of textura intricata, hyphal walls nongelatinized, thin and glassy, ca. 2 µm wide. Asci 8-spored, J- in Melzer's Reagent without KOH pretreatment, J+ and pore walls strongly blue with KOH pretreatment, arising from croziers, 22-30 X 3.0-3.4 µm. Ascospores subellipsoid to fusoid, sometimes with one end broader, mostly uniseriate, 3.5-5.0 X 0.8-1.2 µm. Paraphyses filiform with a blunt apex, less than 1.5 µm wide, exceeding asci 0-3 µm.

Habitat: on leaf blades of an unidentified plant.

Holotype: on leaf blades of an unidentified plant, along trail up Mt. Makiling from Pansol side, Pansol, Luzon, Philippines, K. P. Dumont & I. J. Dogma, Jr., 9. VI. 1966, CUP-SA 901. Isotypes will be issued in Korf & Gruff, Discomycetes Exsiccati.

Paratype: on leaf blades of an unidentified plant,"Go-Go Hill," Mt. Bonahao from the Sariaya side, Luzon, Philippines, K. P. Dumont, P. Zamora, B. Hernaeiz, 14. VI. 1966, CUP-SA 3305 (segregated from mixed collection, CUP-SA 952, mostly of *X. leptospora).*

Notes: The above two species included in *Xeromedulla* are common in habit, shape of apothecia, highly gelatinized, very thick-walled, angular ectal excipular cells, and unicellular, granulate, rudimentary hairs. They differ from each other in hair length, shape of ascospores and of paraphysis apices, and thickness of the medullary hyphal walls. The placement of the genus *Xeromedulla* within the classification is a difficult question. The granulate hyphal protrusions on the receptacle surface recall the hairs of some genera of the Hyaloscyphaceae, but, especially in *X. leptospora,* are poorly developed. We put more emphasis on the anatomical structure than on the presence of reduced hairs, and place this genus in the Leotiaceae. This genus may be close to *Crocicreas.*

ACKNOWLEDGEMENTS

We deeply thank Dr. W. J. Dress of Bailey Hortorium, Cornell University for kindly providing Latin diagnoses, Dr. J. H. Haines of New York State Museum for valuable suggestions and serving as the presubmission reviewer of this paper, and Dr. S. E. Carpenter of Oregon State University and Mr. E. Cope of Bailey Hortorium, Cornell University for consultation.

MYCOTAXON

Vol. XXX, pp. 193-194 October-December 1987

A NEW SPECIES OF UROMYCES ON ATYLOSIA FROM INDIA

G.BAGYANARAYANA

Botany Department, P.G. College of Science,
Saifabad, Hyderabad-500 004 (A.P), India

P.RAMACHAR AND K.NIRANJAN RAO

Mycology Research Centre, Botany Department,
Nizam College, Hyderabad-500 001 (A.P), India

During a survey of the rust fungus flora of Hyderabad, the authors collected rust infected leaves of Atylosia scarabaeoides Benth. The disease was found during the months of October - January. A critical microscopic examination revealed it to be an undescribed species of Uromyces Unger.

Uromyces hyderabadensis Ramachar, Niranjan Rao & Bagyanarayana sp. nov. (Fig.1)

Spermogoniis et aeciis ignota sunt. Urediniis hypophyllis, sparsis, raro aggregatis, subepidermalibus, erumpentis, pulverulentis, epidermide rupta conspicua, cinnamomeo-brunnea, 0.5-1 mm diam, raro coalescentis; urediniosporae 18-29 x 18-22 µm, ovatis vel globosis, membrana 1.5-2 µm crassa, flavido-brunnea, echinulata, poris germinationis 4-6, sparsis. Teliis hypophyllis, sparsis, subepidermalibus, erumpentis, pulverulentis, brunneis; teliosporis 20-26 x 17-27 µm, globosis, subglobosis vel ovatis, parietis bilaminatis, 3-4 µm crassa, apicalis 3-6 µm incrassatis, castaneo-brunnea, verrucosa; pedicello hyalino, usque ad 35 µm longo, fragili.

Holotypus: Foliis vivis Atylosia scarabaeoides Benth. (Papilionoideae), Rajendranagar, Hyderabad (A.P), India, October 1986, leg. G.Bagyanarayana (HCIO).

Spermogonia and aecia not known. Uredinia hypophyllous, scattered, rarely aggregated, subepidermal, erumpent, pulverulent, ruptured epidermis conspicuous, cinnamon brown, 0.5-1 mm in diam., rarely coalescing. Urediniospores 18-29 x 18-22 µm, ovate to globose, wall 1.5-2 µm thick, pale brown, echinulate, germpores 4-6, scattered.

Telia hypophyllous, scattered, subepidermal, erumpent, pulverulent, brown; teliospores 20-26 x 17-27 µm, globose, subglobose, or ovate, wall bilaminate, inner wall smooth, 1-1.5 µm thick, golden brown, outer wall verrucose, 1.5-2.5 µm thick, chestnut brown, apically thickened upto 3-6 µm; pedicel hyaline, upto 35 µm long, fragile.

The urediniospores of Uromyces hyderabadensis are comparable with those of Uredo scarabaeoidis Borique & Bassino and as per Cummins "possibly these two represent the same fungus" (personal communication). Uromyces hyderabadensis is a distinct species and is characteristic in the possession of echinulate urediniospores with 4-6 scattered germpores and the bilaminate teliospores with a smooth inner wall and an outer verrucose wall.

The authors express their grateful thanks to Prof. George B.Cummins for his kind help in the identification of the new rust taxon and in the preparation of the manuscript.

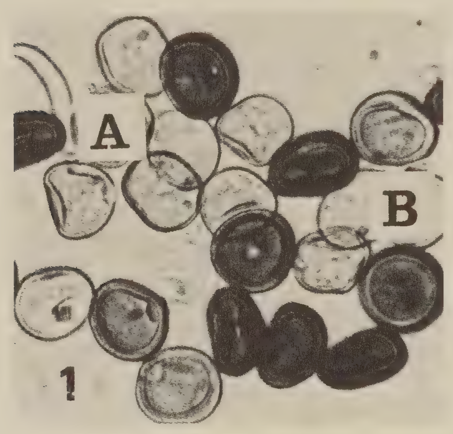


Fig. 1. Uromyces hyderabadensis sp. nov. (A) Thin walled urediniospores (B) Thick walled bilaminate teliospores.

MYCOTAXON

Vol. XXX, p. 195 October-December 1987

CORTICOLOUS MYXOMYCETES FROM CYPRUS

B.ING

Department of Biology, Chester College of Higher Education,
Cheyney Road, Chester CH1 4BJ, U.K.

The island of Cyprus, in the eastern Mediterranean, has not been examined for myxomycetes hitherto. It was therefore interesting to receive in June 1984 a collection of bark from Mount Olympus in the Troodos mountains. The bark was of a species of *Pinus*, possibly *halepensis*, and was brought to me by Mr & Mrs Michael Jones. On culturing the bark in moist chamber nine species of myxomycetes developed, many of interest because of their rarity or unusual occurrence on the bark of living trees.

The only work on corticolous species previously carried out in the eastern Mediterranean is that of Alexopoulos (1959) in Greece and Harkonen & Uotila (1983) in Turkey. Only two of the species recorded here appear on these earlier lists. The work of Binyamini (1986) in Israel does not include corticolous species.

Clastoderma debaryanum Blytt - widespread in southern Europe and Asia but not previously known from the eastern Mediterranean region.
Comatricha alta Preuss - widespread in Europe but rarely recorded from Asia; rare in bark cultures.
C. ellae Harkonen - a rare species previously known only from north-west Europe.
Echinostelium corynophorum Whitney - previously known from North America, Australia and western Europe.
E. minutum de Bary - common and widespread, recorded from Greece and Turkey.
Licea parasitica (Zukal)Martin - common and widespread, recorded from Greece.
L. testudinacea Nann.-Brem. - previously known from western Europe and India.
Stemonitopsis amoena (Nann.-Brem.)Nann.-Brem. - previously known in various parts of western Europe.
Trichia erecta Rex - widespread but uncommon; rare in bark cultures.

Thanks are due to Michael and Ann Jones for collecting the bark.

References: Alexopoulos, C.J. 1959. Myxomycetes from Greece. *Brittonia* 10, 24-40. Binyamini, N. 1986. Myxomycetes from Israel - I. *Nova Hedwigia* 42, 379-386. Harkonen, M. & Uotila, P. 1983. Turkish myxomycetes developed in moist chamber cultures. *Karstenia* 23, 1-9.

MYCOTAXON

Vol. XXX, p. 197 October-December 1987

MYXOMYCETES FROM THAILAND - II

B.ING

Department of Biology, Chester College of Higher Education,
Cheyney Road, Chester CH1 4BJ, U.K.

J.SIWASIN and S.SAMARNPAN

Department of Biology, Chiang Mai University, Chiang Mai,
Thailand

The most recent account of myxomycetes in Thailand (Siwasin & Ing, 1982) listed 34 species, mainly from the northern hill forests. This added sixteen species to those recorded by Reynolds & Alexopoulos (1971.) In June 1981 S.Samarnpan collected seventeen species in dipterocarp forest at Nakhornnayok, north-east of Bangkok. None are new to Thailand but represent a cross-section of species found in tropical rain-forest. Specimens were determined by B.Ing and are housed in the herbarium at Chiang Mai and in Hb.B.Ing. In the list that follows N signifies a species previously found in the northern hill forest and S signifies a species previously found in rain-forest or other lowland sites.

Arcyria cinerea (Bull.)Pers.	N,S.
A. denudata (L.)Wettst.	N,S.
Collaria arcyrionema (Rost.)Nann.-Brem.	N,S.
Cribraria cancellata (Batsch)Nann.-Brem.	N,S.
C. microcarpa (Schrad.)Pers.	S.
Didymium squamulosum (Alb. & Schw.)Fr.	N,S.
Hemitrichia calyculata (Speg.)Farr	N,S.
Physarella oblonga (Berk. & Curt.)Morg.	S, including specimens of f. *alba* Alexop.
Physarum flavicomum Berk.	N,S.
P. melleum (Berk. & Br.)Massee	S.
P. nutans Pers.	N,S.
P. stellatum (Massee)Martin	N.
P. tenerum Rex	S.
P. viride (Bull.)Pers.	S.
Stemonitis smithii Macbr.	N.
S. splendens Rost.	N,S.
Stemonitopsis typhina (Wiggers)Nann.-Brem.	S.

References: Reynolds, D.R. & Alexopoulos, C.J. 1971. South-east Asian Myxomycetes I. Thailand and Burma. *Pacific Science*, 25, 33-38. Siwasin, J. & Ing, B. 1982. Myxomycetes from Thailand. *Nordic Journal of Botany*, 2, 369-370.

MYCOTAXON

Vol. XXX, pp. 199-201 October-December 1987

MYXOMYCETES FROM HONG KONG AND SOUTHERN CHINA

BRUCE ING

Dept. of Biology, Chester College of Higher Education,
Cheyney Road, Chester CH1 4BJ, U.K.

The only previous account of myxomycetes from Hong Kong is that given by Champion & Mitchell (1980.) A number of bark, soil and litter samples from the territory have recently produced several additions to the list. At the same time similar samples have been cultured from sites in the extreme south of China.

LOCALITIES

1. Lamma Island, Hong Kong 22 deg.13' N, 114 deg.7' E. Litter from broad-leaved forest, collected in March 1983 by Yung Kin Ky and cultured by A. Feest at Bristol University.

2. Lantau Island, Hong Kong 22 deg.15' N, 113 deg.58' E. Bark of *Acacia confusa* Merr. (Mimosaceae)(A), *Delonix regia* Raf. (Caesalpiniaceae)(D) and *Pinus massoniana* Lamb. (Pinaceae)(P), collected in August 1983 by Peter Wong and cultured by B. Ing at Chester College.

3. Luk Keng, New Territories 22 deg.28' N, 114 deg.7' E. Bark of *Euphoria longan* Steud. (Sapindaceae)(E) and *Pinus massoniana* collected in August 1984 by Peter Wong and cultured by B.Ing at Chester.

4. Hainan Island, Kwangsi Chuang Region, S. China 19 deg. N, 110 deg.E. Soil and litter from rubber plantation and evergreen forest, collected in March 1983 by Yung Kin Ky and cultured by A.Feest at Bristol.

5. Shenzhen, Kwangtung Province, S. China 22 deg.34' N, 114 deg.5' E. Bark from a small group of *Pinus massoniana* collected in February 1984 by P. Wong and cultured by B. Ing at Chester.

6. Zhaoging lake region, Kwangtung Province, S. China 23 deg.2' N, 112 deg.29' E. Bark of *Bauhinia blakeana* Dunn (Caesalpiniaceae) collected in December 1984 by P. Wong and cultured by B. Ing at Chester.

7. Tai Po Kau Forest, New Territories 22 deg.25' N, 114 deg.11' E. Terrestrial mosses in mixed forest, collected in August 1983 by M.R.D. Seaward and S. Thrower.

Unless otherwise stated the species are widespread in S.E. Asia, although many are new records for Hong Kong. They include the first records of corticolous myxomycetes from mainland China, although Liu (1983) lists thirty-one species from Taiwan. All material has been verified by the author in whose herbarium voucher specimens are housed.

Arcyria cinerea (Bull.)Pers. 1,2,3,5. D,E,P.
Clastoderma debaryanum Blytt 5. P.
Cribraria violacea Rex 3. E.
Diderma chondrioderma (de Bary & Rost.)G.List. 2. A,D.
D. effusum (Schw.)Morg. 2. A.
Didymium difforme (Pers.)S.F. Gray 1.
D. eximium Peck em.Nann.-Brem. 4. This segregate from the *D. iridis* complex has been recorded from India - it is recognised as distinct by Nannenga-Bremekamp (1972.)
D. proximum Berk. & Curt. 4. Another segregate from *D. iridis*, not previously separated in Asia.
Echinostelium minutum de Bary 1,2,3,4,5. A,D,P.
Hemitrichia minor G.List. 2. A,D. Recorded from the Phillipines and Japan.
Licea denudescens Keller & Brooks 6. B. Apparently new to S.E. Asia.
L. erectoides Nann.-Brem. & Yam. 2. A. A fine development of a species recently described from Japan (Nannenga-Bremekamp & Yamamoto, 1983.)
L. kleistobolus Martin 2. A. Known from India and Japan.
L. operculata (Wing.)Martin 2. A,D.
L. pedicellata (H.C.Gilb.)H.C.Gilb. 3. E. Known from India and Japan.
L. scyphoides Brooks & Keller 2. A. Known from India.
Paradiacheopsis cribrata Nann.-Brem. 5. P. Apparently new to Asia.
Perichaena chrysosperma (Currey)List. 2. D.
Physarum bethelii Macbr. 5. P. Recorded from India and Japan.
P. decipiens Curt. 2. D.
P. nutans Pers. 5. P.
P. oblatum Macbr. 2,4. D.
P. sessile Brandza 7. Recorded from India and Japan.

Acknowledgements: thanks are due to Peter Wong for supplying the bark samples, to Dr Alan Feest of the University of Bristol for permission to include the records made during his studies on soil myxomycetes, and to Dr. M.R.D. Seaward for material of *Physarum sessile*.

References: Champion, C.L. & Mitchell, D.W. 1980. Some myxomycetes collected in Hong Kong. *Bulletin of the British Mycological Society*, 14, 135-7. Liu, C.H. 1983. Myxomycetes of Taiwan IV. *Taiwania* 28, 89-116. Nannenga-Bremekamp, N.E. 1972. Notes on myxomycetes XVIII. *Proceedings of the Koninklijke Akademie van Wetenschappen*, C, 75, 352-363. Nannenga-Bremekamp, N.E. & Yamamoto, Y. 1983. Additions to the myxomycetes of Japan 1. *Proceedings of the Koninklijke Akademie van Wetenschappen*, C, 86, 207-241.

MYCOTAXON

Vol. XXX, pp. 203-208 October-December 1987

CULTURAL STUDIES IN FIBRICIUM (CORTICIACEAE, BASIDIOMYCETES)

by

Nils Hallenberg

Department of Systematic Botany, Gothenburg University,
Carl Skottsbergs gata 22, S-41319 Göteborg, Sweden

and

Annarosa Bernicchia

Istituto di Patologia Vegetale, Universita Degli Studi, Via
Filippo Re 8, I-40126 Bologna, Italia

ABSTRACT. Culture characters are given for Fibricium subceracea, and F. rude, and their generic relationship is discussed. Both species are heterothallic with a normal nuclear behaviour.

INTRODUCTION. Fibricium subceracea was originally described as Fibrodontia subceracea on material from Iran (Hallenberg, 1978). In Iran, the species was collected twice in the deciduous forests on the N. slopes of the Elburz mountains. Later, it was collected several times in Italy by Bernicchia and still later by Ryvarden in Argentina (Hjortstam and Ryvarden, 1986). Like some other species reported from N. Iran, F. subceracea seems to have a mediterranean distribution in Europe (see Hallenberg, 1981). Bernicchia transferred the species to Fibricium (in Hjortstam and Ryvarden, 1986), because the micromorphology was similar to F. rude.

Cultures from Italy were used in polarity and intercompatibility tests. The cultural characters for F. subceracea, F. rude, and Fibrodontia gossypina are compared and their generic relations discussed.

METHODS. Fruitbodies which are associated with the cultures studied here, have been carefully investigated and compared with types or other representative material. Single-spore (SS)-cultures and polyspore (PS)-cultures were isolated after dispersal on common malt agar.

Culture characters of the PS-mycelia were analyzed after 3 and 6 weeks growth. Culture codes are from Nobles (1965) with emendations by Boidin and Lanquetin (1983). Drop tests for extracellular oxidases (Syringaldazine, Gum Guaiac, 1-Naphtol, p-Cresol, L-Tyrosine) follow Marr (1979). Nuclear staining was made with Giemsa according to Boidin (1958). Terminology of nuclear behaviour refers to Boidin and Lanquetin (1984).

Even though the number of available SS-cultures was restricted, polarity tests were carried out and compatible mating types designated. In one specimen the type of polarity was indicated. In intercompatibility matings made here, the compatible mating types of each specimen were used.

Data concerning each specimen are given under "material", below. Such data are categorized by slanted lines: Culture number/ substrate/ locality/ SS-numbers of compatible mating types, separated by a slant line, "/".

Cultures are stored in the culture collection at the Department of Systematic Botany, Gothenburg University. The GB-numbers refer to the culture collection. The original specimen together with spore-print can be identified by the same number and are kept in the herbarium (GB).

RESULT OF CULTURAL STUDIES AND COMPATIBILITY TESTS

Fibricium subceracea (Hallenb.)Bernicchia

Description of fruitbody morphology, see Hallenberg (1978).

Specimens in culture:
GB 1593/ Salix/ Italy, Ferrara/ 1,3,6/2; 2 additional SS.
GB 1674/ Populus/ Italy, Ferrara/ 2,9/6,7; 6 additional SS.
GB 1675/ Populus/ Italy, Ferrara/ 1,5/3,6,7,8; 2/4,9,10.
GB 1676/ Populus/ Italy, Ferrara/ 1/2,3; 1 additional SS.

Additional herbarium specimens from Italy, collected by Bernicchia:
Ferrara, Panfilia forest - coll. 407/ Clematis vitalba; coll. 865/ deciduous wood; coll. 860, 1891, 1892/ Quercus pedunculata; coll. 1881, 1882, 1893, 1896/ Populus; coll. 3563/ Corylus; coll. 3567/ Salix.
Venezia, Eraclea - coll. 652, 1147/ Robinia; coll. 1148, 1149/ Cupressus.

Compatibility has been shown between all cultured specimens and the studied fruitbodies were morphologically uniform. The culture characters for GB 1674 and GB 1675 were also the same with exception for the growth rate. In GB 1675 the plates were covered in 3 weeks while the colony radius was only 43 mm after 6 weeks growth in GB 1674.

CULTURE CHARACTERS (GB 1674, GB 1675): Fig. 1 A,C, 2 A,B

Aerial mycelium absent or downy - slightly cottony (scattered patches in old parts). Advancing zone even, appressed.

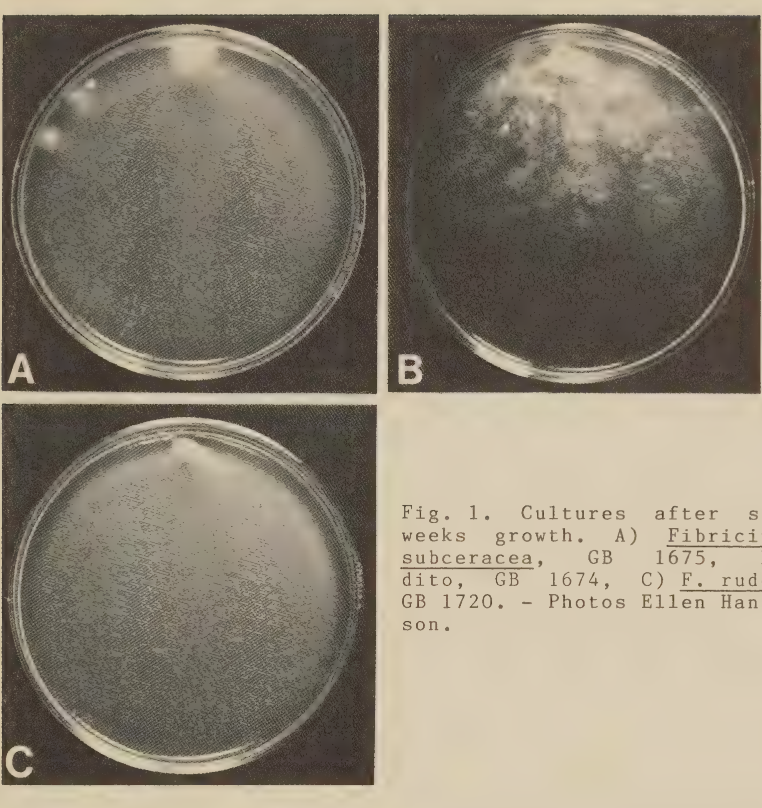


Fig. 1. Cultures after six weeks growth. A) *Fibricium subceracea*, GB 1675, B) dito, GB 1674, C) *F. rude*, GB 1720. - Photos Ellen Hansson.

Hyphae 1,5-6 µm wide, thin-walled, with clamps at all septa; some hyphae have ordinary branching, and may be inflated and somewhat irregular in outline, others are more densely ramified, forming dendrohypha-like structures. The mycelium is to some degree arranged in strands, composed of straight hyphae with slightly ampullate clamps.

CODE: 2a. 3c. (7). (11). (26). 32. 36. 38. (43). (47). 54. 60. 61.
OXIDASE REACTIONS: Syringaldazine, 1-Naphtol, Gum Guaiac, and Guaiacol positive. p-Cresol and L-Tyrosine negative.
POLARITY: Heterothallic, tetrapolarity indicated (GB 1675).
CYTOLOGY: SS-mycelia with uninucleate cells, PS-mycelium dicaryotic.
NUCLEAR BEHAVIOUR: Normal.

Fibricium rude (Karst.)Jül.

Description of fruitbody morphology, see Eriksson and Ryvarden (1975), p 381.

Material:
GB 1720/ Picea/ Norway, Hedmark/ 2/1,4,5,6,8,9,10; 1 additional SS.

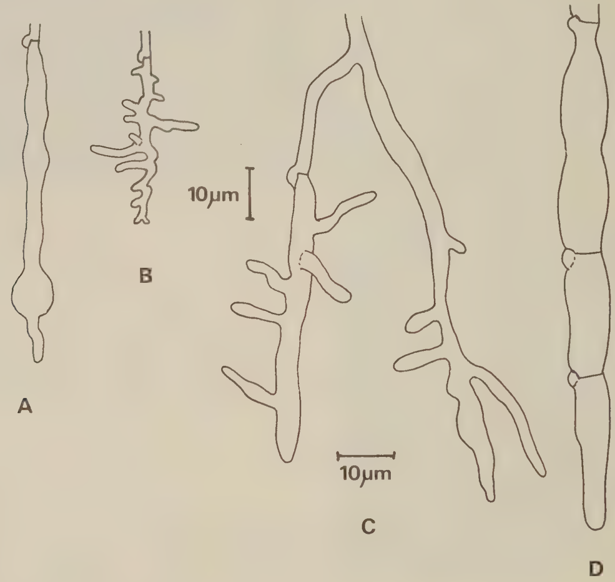


Fig. 2. Culture details. Fibricium subceracea. A) inflated hypha, GB 1674, B) dendrohypha. F. rude. C) marginal hypha with short side-branches, GB 1720, D) inflated hypha.

CULTURE CHARACTERS: Fig. 1 B, 2 C,D

Aerial mycelium absent or slightly downy in old parts. Advancing zone even, appressed. Ordinary branching hyphae, in the margin area with short side-branches; constantly with clamps, thin-walled, 2-9 µm wide, some of the wider hyphae with a slightly irregular outline.
Plates covered in 5 weeks.

CODE: 2a. 3c. (7). (26). 32. 36. 38. 45. 55. 58. 61.
OXIDASE REACTIONS: Syringaldazine, 1-Naphtol, Gum Guaiac, and Guaiacol positive. p-Cresol and L-Tyrosine negative.
POLARITY: Heterothallic, type of polarity unknown.
CYTOLOGY: SS-mycelia with uninucleate cells, PS-mycelium dicaryotic.
NUCLEAR BEHAVIOUR: Normal.

DISCUSSION

Both Fibricium and Fibrodontia are composed of species with a dimitic hyphal system and relatively small, ellipsoid spores. Skeltals and spores are not stained by Melzer's reagent in any species.

The soft and fibrous fruitbodies of Fibrodontia gossypina are micromorphologically similar to species in Hyphodontia. Description of fruitbody morphology is given in Eriksson et al. (1981, p 1063) and the culture characters have been dealt with by Hassan (1981).

The fruitbodies in Fibricium-species are membranaceous. They have a dense subhymenium and clavate basidia, thus differing in their micromorphology from Fibrodontia. Fibricium subceracea has odontioid fruitbodies like Fibrodontia but judging from the micromorphology, it seems to have a better place in Fibricium.

The cultural studies undertaken here and in Hassan (1981) support these generic delimitations. Fibrodontia gossypina has abundant and plumose aerial mycelium and skeletals are present in culture. In Fibricium subceracea and F. rude aerial mycelium is almost absent and there are no skeletals in culture after 6 weeks growth.
On the other hand, these three species have similar oxidase reactions, growth rate, and nuclear behaviour. The big difference in growth rate between GB 1674 and GB 1675 is interesting and resembles the situation in Hericium (Ginns, 1985).

ACKNOWLEDGEMENTS

We are indebted to Ellen Hansson, Göteborg, who made much of the laboratory work and the photos. Financial support was given by the Swedish Natural Science Research Council.

---ooo---

REFERENCES

Boidin, J. 1958: Essai biotaxonomique sur les Hydnés résupinés et les Corticiés. Rev. Mycol. Mém. hors. Sér. 6, 388 pp.
Boidin, J., Lanquetin P. 1983: Basidiomycètes Aphyllophorales épitheloides étalés. Mycotaxon 16 (2): 461-499.
Boidin, J., Lanquetin, P. 1984: Répertoire des données utiles pour effectuer les tests d'intercompatibilité chez les Basidiomycètes. I. Introduction. Cryptog. Mycol. Tome 5: 33-45.
Eriksson, J., Ryvarden, L. 1975: The Corticiaceae of North Europe. Vol. 3. Fungiflora, Oslo.
Eriksson, J., Hjortstam, K., Ryvarden, L. 1981: The Corticiaceae of North Europe. Vol. 6. Fungiflora, Oslo.

Ginns, J. 1985: Hericium in North America: cultural characteristics and mating behavior. Can. J. Bot. Vol. 63 (9): 1551-1563.

Hallenberg, N. 1978: Wood-fungi (Corticiaceae, Coniophoraceae, Lachnocladiaceae, Thelephoraceae) in N. Iran. I. Iran. Journ. Plant Path. 14: 38-87.

Hallenberg, N. 1981: Synopsis of Wood-inhabiting Aphyllophorales (Basidiomycetes) and Heterobasidiomycetes from N. Iran. Mycotaxon 12 (2): 473-502.

Hassan, K.F. 1981: Contribution a la connaissance du genre Hyphodontia Erikss. (Basidiomycètes). Etude systématique et culturale. Thèse Lyon, 87 pp.

Hjortstam, K., Ryvarden, L. 1986: Some New and Noteworthy Fungi (Aphyllophorales, Basidiomycetes) from Iguazu, Argentina. Mycotaxon 25 (2): 539-567.

Marr, C.D. 1979: Laccase and Tyrosinase Oxidation of Spot Test Reagents. Mycotaxon 9 (1): 244-276.

Nobles, M.K. 1965: Identification of Cultures of Wood-inhabiting Hymenomycetes. Can. J. Bot. 43: 1097-1139.

MYCOTAXON

Vol. XXX, pp. 209-219 October-December 1987

TAXONOMIE ET NOMENCLATURE DE DIATRYPE STIGMA, D. DECORTICATA ET D. UNDULATA (DIATRYPACEAE, ASCOMYCETES) <1>

FRANÇOIS RAPPAZ

Université de Lausanne
Institut de Botanique Systématique
et de Géobotanique, Bâtiment de Biologie
CH-1015 Lausanne, Suisse <2>

SUMMARY

Diatrype species with effuse stromata usually determined as *D. stigma* are splitted into three taxa: *D. stigma*, *D. decorticata* and *D. undulata* which are typified. Their teleomorphs and anamorphs in culture are described.

INTRODUCTION

Diatrype stigma est le nom attribué le plus fréquemment aux Diatrypacées montrant un stroma étendu et développé. En Europe, ces champignons sont fréquents dans la nature et abondent ainsi dans les parts d'herbiers. Bien que superficiellement identiques, certains d'entre-eux diffèrent lors d'un examen plus approfondi. Ainsi Füisting (1867), Nitschke (1867), puis Wehmeyer (1926) pressentent que plusieurs taxa, distinguables par leurs conidies de longueurs différentes, sont réunis abusivement sous un seul nom: *D. stigma*, ce qu'ont récemment confirmé Glawe et Rogers (1982, 1984).

Les récoltes européennes appartenant à ce groupe peuvent en effet être attribuées aux trois espèces qui sont présentées ici, ainsi qu'à *D. spilomea* H. Syd. qui sera décrit ultérieurement. Les différences entre ces trois espèces s'expriment surtout en culture, mais les téléomorphes peuvent néanmoins être caractérisés de la façon suivante:

Taxon 1: stroma d'abord grisâtre en surface, devenant brun-noir, souvent plus foncé et crevassé transversalement par de grandes fissures plus ou moins rectilignes, plus régulières, plus espacées et souvent plus larges que ce que montre le taxon 2. Surface moins lisse et brillante, plus mate. Marge disparaissant souvent sous le périderme de la plante-hôte. Ostioles non émergents, aplatis,

---

<1> Travail présenté dans le cadre d'une Thèse de Doctorat à l'Université de Lausanne

<2> Adresse actuelle: rue du Collège 15, CH-1800 Vevey, Suisse

discoïdes, entiers ou peu nettement fendus, souvent de la même couleur que la surface du stroma. Seule espèce de ce groupe à avoir été récoltée sur *Quercus* où elle est très fréquente. Egalement sur *Crataegus*, *Prunus*, *Corylus*... Jamais récoltée sur *Fagus*.

Taxon 2: stroma brun-roux à brun foncé, parfois recouvert par places de l'ectostroma et dans ce cas, d'aspect poudreux grisâtre, devenant lisse et brillant, fendillé transversalement par des fentes sinueuses, irrégulières. Marge irrégulière, lobée, peu marquée ("en pente douce"). Ostioles discoïdes, émergeant faiblement, profondément fendus 3-4 fois. Seule espèce de ce groupe à avoir été trouvée sur *Fagus sylvatica* où elle est fréquente. Egalement sur *Corylus*, *Prunus*, *Acer pseudoplatanus*, *Crataegus*... Jamais récoltée sur *Quercus*.

Taxon 3: stroma d'aspect semblable à 2, mais plus épais, à bords très marqués, plus abrupts. Ostioles souvent assez proéminents, profondément fendus 3-4 fois. Ascospores en moyenne plus courtes que 2 et 1. Récoltée sur *Betula* où elle est fréquente, peut-être aussi sur d'autres Bétulacées (*Carpinus*).

Il a donc été nécessaire de reconsidérer les distinctions proposées par le passé pour les différents noms attribués à *D. stigma*.

HISTOIRE ET NOMENCLATURE

Sphaeria stigma est décrit par Hoffmann (1787) avec un stroma étendu, brun-noir, crevassé transversalement, à bords lobés, des ostioles parfois plans, parfois proéminents. Aucun substrat précis n'est mentionné.

Bulliard (1791) décrit et illustre *Hypoxylon operculatum* avec des indications qui ne permettent pas d'attribuer ce nom à l'un des trois taxon. Mais surtout, comme le souligne Petersen (1977), Bulliard inclut *S. stigma* comme synonyme dans le protologue de *H. operculatum* et en fait donc un nom superflu, typifié automatiquement par le type de *S. stigma* (art. 63 et 7.11).

Sowerby (1798) (Stafleu et Cowan, 1985, TL5: 12.490) illustre, sous *S. decorticata*, une espèce similaire à *D. stigma*, mais la considère dans le protologue comme identique à *H. nummularium* Bull. *Sphaeria decorticata* est donc un nom superflu de ce dernier (qui n'est pas une Diatrypacée) indépendamment du sens taxonomique donné à *S. decorticata* par Sowerby. Plus tard (Sowerby, 1800), il modifie l'épithète "*decorticata*" en "*decorticans*", le premier ayant été "imprimé par erreur". Même si *S. decorticata* avait été légitime, *S. decorticans* aurait dû être rejeté (art. 62).

Persoon (1801) adopte *Sphaeria stigma* et lui donne un sens taxonomique plus précis en distinguant "*S. stigma* α" basé sur le nom de Hoffmann et "*S. stigma* β *Sphaeria decorticata*". Dans l'index du "Synopsis" l'épithète "*stigma*" est imprimée en caractères normaux, utilisés pour indiquer le rang spécifique, alors que "*decorticata*" est en italique, caractères d'imprimerie utilisés pour le rang variétal ou les synonymes. Je considérerai donc que l'épithète "*decorticata*" est utilisée par Persoon pour une variété de *S. stigma*. Cette façon de faire rejoint d'ailleurs la méthode nomenclaturale proposée par

Petersen (1983) et Gams et Kuyper (1984).

Les collections que Persoon (1801) attribue à *S. stigma var. stigma* sont décrites avec des ostioles non proéminents enfouis dans le stroma: "ostiolis immmersis planiusculis", la surface du stroma étant fendue transversalement. *Crataegus oxyacantha* est cité comme substrat. Ces collections se distinguent de celles qu'il attribue à *S. stigma var. decorticata*, caractérisé par un stroma moins épais, sans fentes et surtout des ostioles coniques et émergents. *Corylus avellana*, mentionné comme substrat, et la figure de Sowerby (1798) représentant *S. decorticata*, citée avec un point d'interrogation, complètent la description de la variété.

En dépit de la citation de cette figure, il est possible de considérer l'épithète "*decorticata*" comme publiée par Persoon (art. 72, ex. 2) et prioritaire au rang variétal depuis 1801. Cette nomenclature rend d'ailleurs justice à la taxonomie et à la clairvoyance de Persoon. En effet, déjà sur la base des descriptions de *S. stigma* et de sa variété, on peut attribuer ces deux noms aux taxa 1 et 2 (éventuellement 3) respectivement. L'étude des collections de Persoon (L) confirme cette interprétation.

Sur 7 collections attribuée à *S. stigma*, 6 appartiennent au taxon 1 (la dernière est probablement *D. spilomea*). En particulier le n° L 90 OH 910269-940 est sur *Crataegus*, d'après la structure du bois, substrat cité dans le Synopsis. Cette collection, bien développée, est représentative du taxon 1. Elle est proposée comme néotype de *Diatrype stigma*.

Sous *S. decorticata* et *S. stigma var. decorticata*, deux collections ont été trouvées à L. La première est attribuée au taxon 2, l'autre au 3. Ces deux collections entrent bien dans les limites définies par Persoon. La première (L 90 OH 910270-636) est sur un substrat déterminé par xylotomie comme *Corylus avellana*, substrat cité par Persoon pour *S. stigma var. decorticata*. Cette collection est donc proposée comme néotype pour ce nom.

L'herbier de Persoon comprend également deux collections sous *S. stigma* β *decorticans*, et une sous *S. stigma* β. La première (910270-646) est accompagnée par une lettre de Mougeot, intéressante parce qu'elle souligne les différences morphologiques entre *S. stigma* et sa variété, et précise que le matériel qui l'accompagne est mal déterminé. Cette collection est effectivement *D. stigma* sensu stricto. La seconde est le même taxon, la troisième est jugée trop fragmentaire pour être déterminée, son stroma la rapproche du taxon 3. D'autres collections sous *S. decorticans* (910270-600, -648, -658, -659) montrent un stroma valsoïde et se rapportent à une autre espèce, *S. decorticans* Fr.: Fr. (Fries, 1823).

De Candolle (1805), comme Persoon, reconnaît deux taxa différents. Il accepte d'une part *S. stigma* et élève d'autre part l'épithète variétale "*decorticata*" qu'il attribue à Persoon, au rang spécifique dans le genre *Sphaeria* et crée un nom illégitime puisque homonyme postérieur du nom de Sowerby qui n'intervient pas dans la priorité (art. 45.3).

Fries (1823) distingue aussi deux taxa, mais traite l'épithète *decorticata* au rang variétal et l'attribue à De Candolle, le nom de Persoon n'apparaissant que dans la citation de l'exsiccata distribué par Mougeot et Nestler: "Pers. apud Mougeot l.c. (i.e.: exs.) n°373". D'après L.-R. et C. Tulasne (1863), l'exsiccata 373 est sous *S. decorticans*. Il n'a pas été examiné ici. De Candolle cite Persoon et n'a donc pas l'intention d'introduire un nouveau taxon. C'est donc bien à Persoon que doit rester attachée l'épithète *decorticata*.

Greville (1824) propose une nouvelle combinaison de cette épithète au rang spécifique, dans le genre *Stromatosphaeria*, et forme un nom qui est cette fois légitime. L'épithète *decorticata* est donc prioritaire au rang spécifique depuis 1824, s'applique aux éléments du taxon 2 et se base sur la variété décrite par Persoon (1801).

Persoon (1801) décrit une seconde espèce, *S. undulata*, avec un stroma blanc intérieurement, épais et ondulé, à ostioles proéminents. Cependant, la majorité des collections authentiques examinées sous ce nom correspondent mal à ces caractéristiques et se sont révélées être du genre *Eutypa*. C'est peut-être pour cette raison que Nitschke (1867) considère *S. undulata* Pers. comme différent de *S. undulata* tel que Fries (1823) le décrit. Nitschke base en effet son concept de *S. undulata* sur du matériel de Persoon dans l'herbier de Kunze et attribue cette espèce à *Valsa (Eutypa) scabrosa*, un nom qui n'a pas un sens taxonomique particulièrement clair! Le concept que Fries (1823) adopte pour *S. undulata* correspond cependant au protologue et l'article 7.17 permet de typifier ce nom par du matériel cité dans le Systema, ce qui a été fait ici.

De Candolle (1815) accepte *S. undulata* comme une espèce distincte de *D. stigma* avec une description similaire à celle de Persoon, et cite une collection de Mougeot et Nestler sur *Corylus*.

Fries (1823) adopte une taxonomie identique à celle de De Candolle et cite l'exsiccata n° 371, distribué par Mougeot et Nestler, dont une collection a été examinée (BR). Elle est constituée par deux morceaux de bois collés sur une feuille. En dépit de l'étiquette: "ad ramulos ... Coryli" aucun des deux n'est de ce substrat. Le morceau de gauche, de *Crataegus* d'après la structure du bois, montre une Diatrypacée avec des ostioles peu nettement fendus, une zone nécrosée dorsale uniquement, sans développement entostromatique. Il s'agit probablement d'un spécimen de *Eutypa lata* immature. Le morceau de droite montre une espèce du genre *Diatrype* à stroma étendu et bien développé, sur *Betula* (xylotomie). La surface du stroma est brun-roux, crevassée transversalement, et longitudinalement de façon moins marquée, avec une marge à bords arrondis-lobés et des ostioles faiblement proéminents (< 50 µm), profondément fendus 3-4 fois. Ascospores 5.8-8.5 x 1.5-1.8 µm. Ce matériel correspond mieux au protologue et à la description de Fries que celui sur *Crataegus*. Il correspond également à l'usage ultérieur du nom, en tous cas dans l'interprétation qui a été faite de la description de Fries, comme synonyme de *D. stigma* (L.-R. et C. Tulasne 1863, Nitschke 1867, Saccardo 1882) Ce morceau est donc proposé comme néotype de *S. undulata*.
S. stigma var. quadricocca décrit par Fries (1823) pour une collection également sur *Betula* en est probablement un synonyme.

Fries (1849) maintient ultérieurement la séparation des variétés *quadricocca* et *decorticata*, cette épithète étant attribuée alors à Sowerby.

Fries (1823) propose encore *D. stigma b. (forma) cinerea* basé sur *S. cinerea* (Sowerby, 1802, pl. 373 II), un nom superflu de *S. macula* (Tode, 1790, p. 33 + fig. 106) que Fries considère comme un synonyme de *S. nummularia*. L'illustration de Sowerby de *S. cinerea* suggère un *Diatrype* immature de ce groupe, mais quel que soit le sens du protologue de ce nom, l'inclusion de *S. macula* entraîne sa typification par le type de ce dernier. Le protologue de *S. macula* mentionne une espèce qui se développe parfois dans le bois, ce qui n'est pas le cas de *D. stigma* et de ses espèces voisines. Shear (1941) *discute en détail des différentes spéculations taxonomiques auxquelles S. macula* a donné lieu. Miller (1961) l'attribue à *Hypoxylon serpens* (Pers.: Fr.) Kickx, mais le nom reste de signification douteuse.

Bien que Fries (1823) accepte les distinctions taxonomiques proposées par Persoon, la cohérence des exsiccata des Scleromyceti Sueciae est loin d'être bonne! En effet des collections de *S. stigma* sous le n° 46 de cette série, reçues de PC (Hb. Mont.), FH (Hb. Curtis), UPS (Hb. Fries), montraient du matériel des trois taxa! L'existence de "crypto-éditions" dans cette série (Holm et Nannfeldt, 1962) joue probablement un rôle important dans l'explication de ces mélanges. La présence de confusions semblables, avec d'autres espèces pourtant facilement identifiables, par exemple *S. dissepta*, en est une preuve.

L.-R. et C. Tulasne (1863) réunissent tous ces différents noms sous *Stictosphaeria hoffmannii*, nom superflu et illégitime, l'épithète *stigma* ayant été abandonnée. Et même si la description qu'ils publient est basée sur du matériel homogène, récolté sur *Quercus*, qui appartient au taxon 1, d'autres plantes-hôtes sont citées et il est possible que leur concept soit plus large que ce que laisse supposer la description seule.

Füisting (1867) décrit chez cette espèce trois types de conidiomata, produisant chacun des conidies de longueurs différentes, observation qui pourrait avoir suggéré à Nitschke (1867) que plusieurs espèces sont réunies sous *D. stigma*. Mais ce dernier observe une grande variabilité dans la taille des ascospores -son concept de *D. stigma* englobe en réalité *D. spilomea* et *D. undulata*, à petites ascospores, avec *D. stigma*, dont certaines collections montrent des ascospores de grande taille- qu'il n'arrive pas à relier avec d'autres variations morphologiques. Il abandonne finalement et conserve un concept très large pour cette espèce.

Wehmeyer (1926) souligne l'utilité de la taille des conidies comme caractère discriminant, hypothèse qui sera confirmée par Glawe et Rogers (1982, 1984). Ces derniers reconnaissent cinq taxa décrits principalement avec des collections américaines (Glawe et Rogers, 1984). Les deux premiers taxa sont probablement absents d'Europe, les trois autres correspondent à ceux qui sont présentés ici.

DESCRIPTION DES ESPECES

Quelques indications succinctes concernant les méthodes de travail ont été données prédédemment (Rappaz, 1984). Leur description complète sera publiée prochainement.

DIATRYPE STIGMA (Hoffm.: Fr.) Fr., Summa veg. Scand. 2: 385. 1849. (Fig. 1, 4, 7, 10)

Sphaeria stigma Hoffm.: Fr., Veg. crypt. 1: 7. 1787, Syst. mycol. 2: 350. 1823.

Stromatosphaeria stigma (Hoffm.: Fr.) Grev., Fl. edin.: 356. 1824.

Hypoxylon stigma (Hoffm.: Fr.) J. Kickx fil., Fl. crypt. Louvain: 114. 1835.

Hypoxylon operculatum Bull. Hist. champ. France: 177. 1791 (illeg. 63).

Stictosphaeria hoffmannii Tul. & C. Tul., Sel. Fung. carp. 2: 49. 1863 (illeg. 63).

Stroma: étendu dans le parenchyme cortical, non recouvert du périderme; surface plane, non bosselée, d'abord grisâtre puis brun-noir, mate, crevassée transversalement de façon régulière; marge peu marquée; stroma limité par une ligne noire et par une zone nécrosée ventrale développée, interrompue par de nombreux prolongements entostromatiques reliant le stroma au bois; entostroma blanc développé à hauteur des cols des périthèces, parfois jusqu'à mi-hauteur des ventres. **Ostioles**: séparément émergents, parfois mal délimités, le plus souvent discoïdes et aplatis, de la même couleur que le stroma, non proéminents, finement et nettement fendus 3-4 fois, diam. 80-100 µm. **Périthèces**: sur un rang, en contact ou le plus souvent comprimés les uns contre les autres, sphériques à ovoïdes, dim. 300-500 µm, à col court. **Asques**: p. sp. 25-50 x 5-6 µm, pédicelle 40-75 µm, anneau apical I+. **Ascospores**: jaune pâle, 5.8-10.5 x 1.5-2 µm. **Conidiomata**: surface orangée de contour plus ou moins circulaire, située directement sous le périderme et formée par de nombreuses cavités confluentes-labyrinthiformes, excepté au centre où une colonne de tissu plus ou moins mélanisé persiste. Conidies identiques à celles obtenues en culture, exsudées en masses orange.

Substrat: écorce de *Quercus (Fagaceae)*, également sur *Rosaceae*, *Betulaceae*; Europe, Amérique du Nord.

Matériel examiné: **Sous *Sphaeria stigma***: xyl.: *Crataegus sp.* (L-Pers. 90 OH 910269-940, proposé comme NEOTYPE); "n° 390", xyl.: *Carpinus betulus* (L-Pers. 90 OH 910269-773); (L-Pers. 90 OH 910269-931); (L-Pers. 90 OH 910269-761, annoté "junior"); Prob. *Quercus sp.* (L-Pers. 90 OH 910269-772); Mougeot (L-Pers. 90 OH 910269-941); xyl.: *Corylus avellana* (PC-Mont., Fr., Sclerom. Suec. exs. 46, morceau du haut, en bas: *D. decorticata*); prob.: *Quercus sp.*, Lorient (PC-Mont.); *Quercus sp.*, Lyon (PC-Mont., nom attribué à DC.); xyl.: *Corylus avellana* ou *Betula* (PC-Mont., nom attribué à Pers.); xyl.: *Quercus sp.*, St.-Germain (PC-Mont., nom attribué à Tode); (PC-Mont. nom attribué à Hoffm.); xyl.: *Corylus avellana* (FH-Curtis, Fr., Sclerom. Suec. exs. 46). **Sous *Diatrype stigma***: Krieger, 1882-1883, *Quercus sp.*, Königstein, Saxe, RFA (BR, Rabenh.-Wint., Fung. Europ. 2953 a, avec conidiomata); *Quercus sp.* (BR, Fuckel, Fung. Rhen. 2263, avec conidiomata); Serebriannikov, 9-1894, *Quercus sp.*, Petrovsko-Rasumovskoje (URSS) (BR, Jacz.-Kom.-Tranz., Fung. Ross. exs. 189); Magnus, 22-7-1883, *Crataegus oxyacantha* (BR-E. Bommer & M. Rousseau, 2 colls). **Sous *Stictosphaeria hoffmannii***: (BR, Fuckel, Fung. Rhen. 1043, Morceau de gauche, en mélange avec *D. decorticata*). **Sous *Sphaeria stigma* β *decorticans***: Mougeot n° 20 (L-Pers. 90 OH 910270-646, d'abord déterminé comme *S. stigma*); (L-Pers. 90 OH 910269-763). **Sous *Sphaeria decorticans***: xyl.: *Quercus sp.* (BR, Roumeguère 281, ex Stirpes Crypt. Vog. exs. 373 ?, morceaux de gauche en haut et en bas, mélangés avec *D. undulata*).

Matériel récolté (LAU): **France**: 4-1982, *Carpinus betulus*, Bissy-sous-Uxelles, Saône-et-Loire (225); 26-6-1986, idem, idem (559a); idem, *Corylus avellana*, idem (561); 6-1981, *Quercus ilex*, Contes/Nice, Alpes-Maritimes (144); 6-1986, *Castanea sativa*, St-Gall/Saverne, Bas-Rhin (560). **Irlande**: 30-7-1985, *Quercus sp.*, Co. Wicklow, Loch Dan (517: CBS 211.87). **Suisse**: *Corylus avellana* (118); *Quercus sp.* (48, 54). *Crataegus sp.* (256 b, 139); *Pyrus sp.* (181).

Anamorphe en culture (MA) (Fig. 1, 4): mycélium aérien blanc à blanc-crème, épais ou plus ou moins appliqué, ouateux-méchuleux, parfois ras et plus épais seulement vers la marge. Agar mélanisé sous les zones de conidiogenèse ou sous l'inoculum. Marge assez lâche, irrégulière et appliquée, atteignant le bord de la boîte en 10 jours. Conidies produites après 15-20 jours, en masses orange à brun-orange dans des cavités du mycélium ou des concrétions plus ou moins pycniformes parfois assez grosses (2-3 mm), ou produites directement dans le mycélium aérien, allantoïdes, 4.5-7.5 x 1-1.2 µm.

Certaines récoltes montraient un stroma d'aspect similaire à *D. stigma*, et produisaient en culture des conidies allantoïdes de 6-8.5 x 1-1.2 µm, mais qui différaient de ce taxon par la taille de leurs ascospores: 7.5-13.2 x 2-2.5 µm. Ces récoltes ont été faites en Suisse sur *Cercis siliquastrum* (411a) et *Acer campestre* (525d) dans la même localité. Un exemplaire (GOET) sous le n°170 des exsiccata distribués par Ehrhart, cité par Fries (1823) sous *D. stigma*, est identique. Ce matériel est sur *Corylus avellana* d'après la structure du bois. Une distinction nomenclaturale de ces souches me paraît actuellement prématurée.

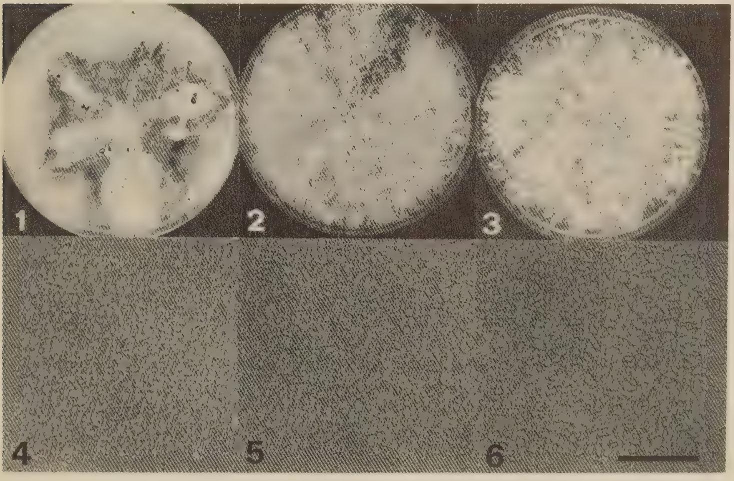


Fig. 1-3. Anamorphes en culture (MA). Diamètre des boîtes: 9 cm. Fig. 4-6. Conidies (microscopie en contraste de phase, bleu coton). Fig. 4-6 à la même échelle: le trait: 100 µm. 1, 4. *Diatrype stigma* (LAU: Rappaz-517); 2, 5. *D. decorticata* (540); 3, 6. *D. undulata* (537).

DIATRYPE DECORTICATA (Pers.; Fr.) F. Rappaz, comb. nov. (Fig. 2, 5, 8)

Sphaeria stigma Hoffm. var. *decorticata* Pers.: Fr., Syn. meth. fung.: 21. 1801 (sous "β *Sphaeria decorticata*"), Syst. mycol. 2: 350. 1823 (sous "*decorticata* (DC.) Fr.").

Diatrype stigma (Hoffm.) Fr. var. *decorticata* (Pers.: Fr.) Fr., Summa veg. Scand. 2: 385. 1849 (sous "*decorticata* (Sowerby) Fr.").

Sphaeria decorticata (Pers; Fr.) DC. in DC. & Lamarck, Fl. franç. 3(2): 289. 1805 (sous "*decorticata* Pers.")(illeg. 64) non Sowerby, 1798 nec Schwein., 1832.

Stromatosphaeria decorticata (Pers.; Fr.) Grev., Fl. edin.: 357. 1824.

Diatrype stigma (Hoffm.) Fr. var. *exserta* J. Kickx fil., Fl. crypt. Flandres 1: 301. 1867 (illeg. 63).

Stroma: étendu dans le parenchyme cortical, non recouvert du périderme, brun-roux à brun-noir, lisse, crevassé transversalement par des fentes en dents de scie plus ou moins marquées, parfois un peu bosselé; entostroma blanc développé entre les périthèces, ou au moins à hauteur des cols; zone entostromatique fortement différenciée sous les périthèces, reliée au bois par de nombreuses colonnes comme chez *D. stigma*. **Ostioles**: séparément émergents, en général faiblement proéminents, discoïdes ou arrondis, plus ou moins nettement fendus à cruciformes, diam. 80-100 µm. **Périthèces**: sur un rang, en contact à comprimés les uns contre les autres, sphériques à ovoïdes, dim. 300-500 µm, à col court. **Asques**: p. sp. 25-50 x 4-7 µm, pédicelle 40-80 µm, anneau apical I+. **Ascospores**: jaune pâle, 6-9.5 x 1.5-2 µm.

Substrat: écorce de *Fagus sylvatica (Fagaceae)* et fréquent également sur *Betulaceae*, *Rosaceae*; Europe, Amérique du Nord.

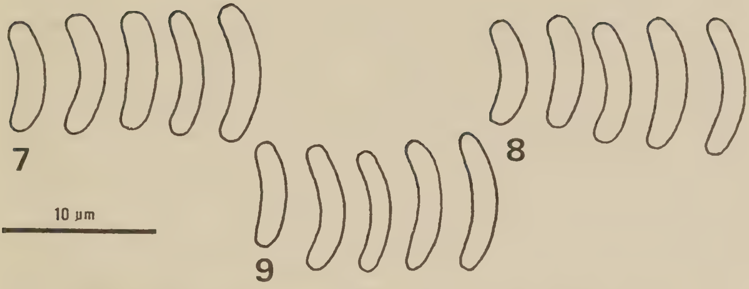
Matériel examiné: **Sous *Sphaeria decorticata***: xyl.: *Corylus avellana* (L 90 OH 910270-636, proposé comme néotype de *S. stigma var. decorticata*). **Sous *Sphaeria stigma***: xyl.: *Fagus sylvatica* (PC-Mont., Fr., Sclerom. Suec. exs. 46, morceau du bas, en haut: *D. stigma*). **Sous *Stictosphaeria hoffmannii***: (BR, Fuckel, Fung. Rhen. 1043, morceau de droite, en mélange avec *D. stigma*). **Sous *Diatrype stigma***: Magnus, 14-8-1884, *Fagus sylvatica* (BR). **Sous *Diatrype stigma***: (BR, Rabenh.-Wint., Fung. Europ. 2953 b, avec conidiomata); (BR, Romell, Fung. exs. pr. Scand. 170); (BR, Petr., Fl. Boh. & Mor. exs. 2, 1(3): 142 + 142 b). **Attribution incertaine**: Sous *Sphaeria stigma*: (BR, BR-Martii, UPS-Fr., Schmidt & Kunze, Deutsch. Schwämme exs. 101, nom attribué à Pers.).

Matériel récolté (LAU): **France**: 4-1982 *Carpinus betulus* Bissy/Uxelles, Saône-et-Loire (232); 4-1983, *Carpinus betulus*, Les Eyzies-de-Tayac, Dordogne (324b+c); 11-5-1983, *Fagus sylvatica*, Causse du Larzac, Hérault (342). **Suisse**: *Acer sp.* (11, 250b); *Corylus avellana* (15, 95); *Fagus sylvatica* (61, 540: CBS 222.87); *Crataegus sp.* (256 a); *Prunus sp.* (75, 433); *Salix sp.* (147 a); *Tilia sp.* (435).

Anamorphe en culture (MA) (Fig. 2, 5): mycélium aérien blanc, appliqué, formant des épaississements en cordons radialement orientés plus ou moins marqués, plus épais vers le centre. Marge en cordons lâchement emmêlés dans l'agar, atteignant le bord de la boîte en 12 jours env., pas de coloration inverse particulière, rarement (surtout les isolements de Betulacées) brune plus ou moins marquée. Conidies produites après 15-20 jours, dans des cavités du mycélium aérien confluentes en bandes orientées radialement et plus ou moins mélanisées, en masses orange clair devenant brun-orangé, droites ou peu courbées, 14-24 x 0.8-1.2 µm.

Cette description est similaire à celle que donnent Glawe et Rogers (1982) d'une culture d'un *Diatrype* récolté sur *Fagus sylvatica* en Grande-Bretagne, excepté la longueur des conidies. Ils observent en effet des longueurs variant entre (17)23 et 28 µm. Il est possible que le milieu utilisé (PDA) et les conditions de croissance expliquent en partie cette différence.

Une des récoltes sur Carpinus (324 b) n'est attribuée à *D. decorticata* qu'avec hésitation. Elle montre un stroma dont l'aspect est celui de *D. stigma*, mais avec des conidies longues de 9 à 17 µm, et des ascospores de 7.5-9.5 x 1.8-2 µm, une taille qui l'exclut de *D. undulata*.



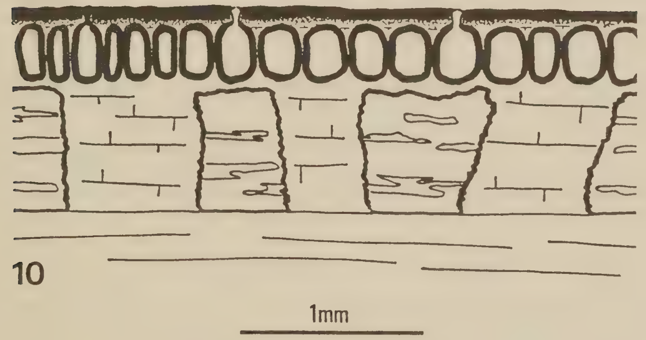


Fig. 7-9. Ascospores. Fig. 7-9 à la même échelle. 7. *Diatrype stigma* (LAU: Rappaz-517); 8. *D. decorticata* (540); 9. *D. undulata* (BR: néotype). Fig. 10. Section verticale schématisée d'un stroma de *D. stigma* (517).

DIATRYPE UNDULATA (Pers.: Fr.) Fr., Summa veg. Scand. 2: 385. 1849. (Fig. 3, 6, 9)

Sphaeria undulata Pers.: Fr., Syn. meth. fung.: 21. 1801, Syst. mycol. 2: 350. 1823.

Stromatosphaeria undulata (Pers.: Fr.) Grev., Fl. edin.: 356. 1824.

Stictosphaeria undulata (Pers.: Fr.) Fuckel, Fungi Rhenani exsiccati fasc. 11 exs. 1044. 1864.

Sphaeria stigma Hoffm. var. *quadricocca* Fr.: Fr., Syst. mycol. 2: 350. 1823.

Diatrype stigma (Hoffm.) Fr. var. *quadricocca* (Fr.: Fr.) Fr., Summa veg. Scand. 2: 385. 1849.

Diatrype stigma (Hoffm.) Fr. var. *rugosa* J. Kickx fil., Fl. crypt. Flandres 1: 301. 1867.

Stroma: dans le parenchyme cortical, en plaques plus ou moins étendues, parfois relativement limitées; fortement émergent et à marge bien délimitée, de contour lobé-ondulé; non recouvert du périderme; surface brun-roux à brun-noir, lisse, crevassée finement transversalement en dents de scie plus ou moins marquées; entostroma blanc développé entre les périthèces, ou au moins à hauteur des cols; zone entostromatique fortement différenciée sous les périthèces, reliée au bois par de nombreuses colonnes. **Ostioles**: séparément émergents, peu ou pas proéminents à nettement émergents (< 100 µm), discoïdes à coniques, cruciformes, rarement peu nettement fendus, diam. env. 100 µm. **Périthèces**: sur un rang, en contact à comprimés les uns contre les autres, sphériques à ovoïdes, dim. 300-500 µm, à col court. **Asques**: p. sp. 25-40 x 4-7 µm, pédicelle 40-90 µm, anneau apical I+. **Ascospores**: jaune pâle, 5-8 x 1.2-1.8 µm.

Substrat: écorce d'espèces du genre *Betula (Betulaceae)*; Europe et probablement Amérique du Nord.

Matériel examiné: **Sous *Sphaeria undulata***: "Ad ramulos emortuos Coryli", xyl.: *Betula* (BR, Moug. & Nest., Stirpes Crypt. Vog. exs. 371, morceau de droite, proposé comme néotype de *S. undulata*). **Sous *Sphaeria stigma var. decorticata***: xyl.: *Betula* (L-Pers. 90 OH 910269-762). **Sous *Sphaeria decorticans***: xyl.: *Betula* (BR, Roumeguère 281, ex Stirpes Crypt. Vog. exs. 373 ?, morceau de droite en haut, mélangé avec *D. stigma*). **Sous *Sphaeria stigma***: xyl.: *Betula* (UPS-Fr., Sclerom. Suec. exs. 46); Wormskiold, xyl.: *Betula*, Kamtschatka (UPS-Fr.). **Sous *Sphaeria subaffixa***: xyl.: *Betula*, "Beth." New Jersey, USA (PH-Schwein., Collins 47). **Sous *Diatrype stigma***: Karl, *Betula alba*, Königswald (BR, Rabenh., Fung. Europ. 820); Romell, 15-7-1891, *Betula alba* (BR, Romell, Fung. exs. pr. Scand. 169). **Attribution incertaine**: Sous *S. stigma* β: (L-Pers. 90 OH 9102369-771, annoté "cum S. episph.").

Matériel récolté (LAU): **Suisse**: *Betula sp.* (214, 217, 268, 537: CBS 271.87).

Anamorphe en culture (MA) (Fig. 3, 6): mycélium aérien blanc, ras, appliqué, peu dense, sans cordons différenciés, portant de nombreuses concrétions sphériques (dim. 0.5-2 mm), non mélanisées, réparties de manière dense. Agar fréquemment coloré en brun sous le mycélium, non mélanisé. Marge courte, régulière, densément emmêlée, atteignant le bord de la boîte en 16 jours env. Conidies produites après 3 semaines, formées dans les concrétions plutôt vers le centre de la culture, vers la marge dans de très petites cavités du mycélium, ou produites en surface, en masses orange plus ou moins foncé, moyennement à faiblement courbées mais en général plus nettement courbées que les isolements de *D. decorticata*, 11-19 x 0.8-1.2 µm.

REMERCIEMENTS

J'exprime ma reconnaissance à Messieurs les Professeurs A. Bolay, H. Clémençon et E. Müller pour les responsabilités qu'ils ont bien voulu assumer pendant mon travail de doctorat. Je remercie les conservateurs des herbiers BR, FH, GOET, L, PC, PH, UPS pour les prêts de matériel cités ici.

BIBLIOGRAPHIE

BULLIARD, J. B. F. 1791. Histoire des champignons de la France 1: 1-232. Paris.

CANDOLLE, A. P. DE. 1805 in Lamarck, J. B. A. P. M. de & Candolle A. P. de. Flore Française. ed. 3. 2: 1-600. Paris.

CANDOLLE, A. P. DE. 1815. Flore française 5: 1-662. Paris.

FRIES, E. M. 1823. Systema mycologicum 2: 275-620. Lund.

FRIES, E. M. 1849. Summa vegetabilium Scandinaviae 2: 259-572. Uppsala.

FÜISTING, W. 1867. Zur Entwickelungsgeschichte der Pyrenomyceten. Botanische Zeitung 25(23): 177-181.

GAMS, W. & KUYPER, TH. W. 1984. Problems involved in the sanction of fungal names. Mycotaxon 20: 619-631.

GLAWE, D. A. & ROGERS, J. D. 1982. Observations on the anamorphs of six species of *Diatrype* and *Diatrypella*. Can. J. Bot. 60: 245-251.

GLAWE, D. A. & ROGERS, J. D. 1984. *Diatrypaceae* in the Pacific Northwest. Mycotaxon 20(2): 401-460.

HOFFMANN, G. F. 1787. Vegetabilia cryptogama 1: 1-42. Erlangae.

HOLM, L. & NANNFELDT, J. A. 1962. Fries's "Scleromyceti Sueciae". A study on his editorial history with an annotated check-list. Friesia 7: 10-59.

MILLER, J. H. 1961. A monograph of the world species of *Hypoxylon*: 1-158. Athens.

NITSCHKE, T. R. J. 1867. Pyrenomycetes germanici. 1: 1-160. Breslau.

PERSOON, C. H. 1801. Synopsis methodica fungorum: 1-706. Göttingen.

PETERSEN, R. H. 1977. An annotated index for Bulliard's "Histoire des Champignons". Mycotaxon 6: 127-166.

PETERSEN, R. H. 1983. Some perplexing problems associated with the use of Fries's systema mycologicum as a sanctioning book. Cryptog. Mycol. 4: 221-230.

RAPPAZ, F. 1984. Les espèces sanctionnées du genre *Eutypa* (Diatrypacées, ascomycètes). Etude taxonomique et nomenclaturale. Mycotaxon 20(2): 567-586.

SACCARDO, P. A. 1882. Sylloge fungorum 1: 1-766. Padua.

SHEAR, C. L. 1941. Mycological Notes 5. Mycologia 33: 318-332.

SOWERBY, J. 1796-1803. Coloured figures of English fungi. vol. 1-3. pl.1-400. London.

STAFLEU, F. A. & COWAN, R. S. 1976-1985. Taxonomic literature ed. 2 vol. 1-5. Utrecht.

TODE, H. J. 1790-1791. Fungi mecklenburgenses selecti. Lüneburg.

TULASNE, L.-R. & TULASNE, C. 1863. Selecta Fungorum carpologia 2: 1-319. Paris. (Traduction anglaise de W. B. Grove. Oxford. 1931).

WEHMEYER, L. E. 1926. A biologic and phylogenetic study of the stromatic *Sphaeriales*. Amer. J. Bot. 13: 575-645.

MYCOTAXON

Vol. XXX, pp. 221-238 October-December 1987

THE KNOWN SPECIES OF PHAEOCOLLYBIA (AGARICALES, CORTINARIACEAE) IN MEXICO *

Gastón Guzmán
Victor M. Bandala-Muñoz

and

Leticia Montoya-Bello

Instituto Nacional de Investigaciones sobre
Recursos Bióticos
Apartado Postal 63
Xalapa, Veracruz, 91000, Mexico

SUMMARY

Seven species of Phaeocollybia (Agaricales, Cortinariaceae) are discussed, of which P. spoliata Horak, P. attenuata (Smith) Sing. ssp. attenuata, P. christinae (Fr.) Heim and P. californica Smith are new records from Mexico (States of Veracruz and Hidalgo), and P. mexicana Corner & Horak, P. kauffmanii (Smith) Sing. and P. lugubris (Fr.) Heim are recorded for the first time from the States of Veracruz and Morelos. These fungi are common in coniferous forests and characterized by their stipe with a subterranean elongation (pseudorhiza) deeply buried in humus.

* This paper was supported by CONACYT (PCECCNA-040381 "Estudios sobre la producción de los hongos comestibles en los bosques de México"), and was presented by the authors in the II National Congress of Mycology, at Oaxtepec, Morelos, Mexico, in November 1986.

INTRODUCTION

The genus Phaeocollybia Heim (Cortinariaceae) is mainly restricted to boreal or temperate woods (Smith, 1957; Smith & Trappe, 1972; Farr & Farr, 1976; Horak, 1976-77; Guzmán, 1977; Redhead & Malloch, 1986) while only few species occur in tropical regions (Singer, 1970). In Mexico the knowledge of this genus is very limited and all the known species have been founded in coniferous forests. The genus is well defined by a cartilaginous fruiting body, a long tapering stipe buried in the ground (known as pseudorhiza), and by the verrucose spores.

Concerning to the biology of this genus, it was first supposed to be mycorrhizal, but Smith (1957) suggested that some species are not mycorrhizal, and Smith & Trappe (1972) concluded that "the ecological relationships of the species .... still remain to be determined". Horak (1976-77) considered the possibility of it inhabit rotting roots of conifers, and Singer (1970) contemplated the idea that the species might be root pathogens, saprophytes, or mycorrhizal symbionts. Recently, Redhead & Malloch (1986) studying several collections under field conditions suggested that Phaeocollybia is a root parasitie.

Only 4 species of Phaeocollybia are reported for Mexico. In the first study (Singer, 1957) describes P. attenuata ssp. mexicana Sing. from the State of Mexico. Guzmán (1973; 1977) later mentions the ocurrence of P. kauffmanii (Smith) Sing. in Mexican coniferous forests. The same species has also been reported from the States of Hidalgo (Varela & Cifuentes, 1979; Frutis & Guzmán, 1983), Veracruz (Villarreal & Guzmán, 1984), Durango (Pérez-Silva & Aguirre-Acosta, 1985) and Morelos (López et al., 1985). Corner and Horak (in Horak, 1976-77) described P. mexicana Corner & Horak from the Desierto de Los Leones, Distrito Federal. Frutis & Guzmán (1983) and Pérez-Silva & Aguirre-Acosta (1985) reported P. lugubris (Fr.) Heim from the States of Hidalgo and Durango, respectively.

Since the summer of 1983 the authors have made numerous mycological explorations to the Cofre de Perote Region (Veracruz State), where they found several species of Phaeocollybia not previously reported from Mexico, which are described here. Collections of the ENCB Herbarium (Instituto Politécnico Nacional at Mexico City) were also consulted in the present study.

KEY TO THE SPECIES OF *PHAEOCOLLYBIA* IN MEXICO

1. Cheilocystidia clavate, cylindrical or filiform, never capitate -------------------------------- 2

  2. Spores 4-5 µm broad. Pileus viscid, cinnamon brown to ochraceous brown or yellowish brown ---------------------------- 3. *P. christinae*

  2. Spores more than 5 µm broad. Pileus viscid or lubricous, reddish tinges present or not -- 3

    3. Pileus viscid, reddish tinges present, with a distinct gelatinized pileus cuticle. Spores 9-10 x 5-7 µm ----- 4. *P. kauffmanii*

    3. Pileus lubricous to dry, reddish tinges absent. Pileus cuticle poorly gelatinized. Spores 8-9 (-10) x 5-6 µm--1. *P. attenuata*

1. Cheilocystidia capitate somewhat ventricose --- 4

  4. Cheilocystidia capitulum more than 4 µm broad --------------------------- 7. *P. spoliata*

  4. Cheilocystidia capitulum 0.8-2 µm broad ----- 5

    5. Pileus, lamellae and stipe with olivaceous tinges. Cheilocystidia frequently forked ------------------------- 5. *P. lugubris*

    5. Pileus without any olivaceous tinge. Cheilocystidia not forked ------------------ 6

      6. Cheilocystidia 1.6-2.4 (-3.2) µm broad ---------------------- 6. *P. mexicana*

      6. Cheilocystidia 5-6 (-7) µm broad ---------------------- 2. *P. californica*

DESCRIPTION OF THE SPECIES

1. *Phaeocollybia attenuata* (Smith) Sing., Lilloa 22: 567, 1951, ssp. *attenuata*

Figs. 1-3

Pileus 28-34 mm broad, conical to campanulate with a conical papilla, with an inrolled margin, surface smooth or slightly rugose, lubricose to dry, light orange brown to light yellowish brown, hygrophanous. Lamellae subadnexed, somewhat broad, crowded, yellowish to feruginous, with whitish and smooth edges. Stipe 110-160 x 7-9 mm, fusoid, tapered downward to a pseudorhiza, buried into the ground almost half its lenght, subpolished,concolorous with the pileus above, darkening towards the base, fibrous. Context yellowish brown with reddish tinges, subcartilaginous to fibrous; farinaceous odour and taste present.

Spores 8-9(-10) x (4-) 5-6 µm, sublimoniform to subellipsoid, verrucose, yellowish brown in KOH, inamyloid, thin walled. Basidia (26-) 30-32 x 7-9(-11) µm, clavate, 4-spored, hyaline. Pleurocystidia absent. Cheilocystidia (26-) 30-32 x 5-7 µm, common, clavate to subfilamentous (basidiole-like), hyaline, thin walled, sometimes with a medial septum. Cuticle with hyphae slightly gelatinized, 4-7 µm wide, light orange brown to yellowish, thin walled, incrusted. Pileus trama with hyphae (3-) 4-6 (-7) µm wide, hyaline to yellowish, thin walled. Gill trama subregular, hyphae 3-7 µm wide, hyaline, sometimes mixed with yellowish brown thin walled hyphae. Clamp connections absent.

HABITAT. Solitary on humus, in *Pinus* and *Abies* forests.

MATERIAL STUDIED. STATE OF HIDALGO: National Park El Chico, San Miguel El Cerezo, Valenzuela 806 (ENCB). STATE OF VERACRUZ: Eastern Cofre de Perote region, Xico County, El Revolcadero, Bandala-Muñoz 496 (XAL).

OBSERVATIONS. This species is distinguished by the subgelatinized pileus cuticle, its color and the cheilocystidia shape. It is closely related to *P. kauffmanii* (Smith) Sing. but the viscid pileus and reddish tinges in the later differentiate these two species.

Singer (1957; 1970) described P. attenuata ssp. mexicana Sing., which differs from P. attenuata ssp. attenuata in pileus colours "deep chestnut brown fades to ochraceous brown or ochraceous tawny" reporting it from a coniferous forest (with Pinus and Abies) from the State of Mexico (Popocatepetl-Iztaccihuatl region). Smith (1957) recorded P. attenuata ssp. attenuata from the Picea, Pseudotsuga and Sequoia woods in the U.S.A. and he characterized it for the pileus colours: "amber brown when moist or near ochraceous tawny, hygrophanous, fading to ochraceous buff or warm-buff (pale yellow)"; it seems that the deeper colour in P. attenuata ssp. mexicana is the only difference from subspecies attenuata.

Singer (1975) estabilished both subspecies under the section Phaeocollybia, but later (1986) considered P. attenuata ssp. mexicana as synonym of P. neosimilis Sing. in the same section, while P. attenuata ssp. attenuata was apparently not discussed by him. This fungus was previously known only from the U.S.A. (Smith, 1957; Horak, 1976-77).

2. Phaeocollybia californica Smith, Brittonia 9: 216, 1957.
Figs. 4-6

Pileus (17-) 20-25 mm broad, conical to campanulate somewhat acute in the apex, becoming convex-umbonate, the margin slightly inrrolled, glabrous, viscid, reddish orange to orange brown, hygrophanous. Lamellae subadnexed, crowded, concolorous with the pileus to ferruginous. Stipe 40-50 (-100) x 3-4 mm, fusoid, buried in the ground by a long pseudorhiza, concolorous with the pileus above, darkening towards the pseudorhiza, smooth, polished, fibrous to cartilaginous.

Spores 9-10 (-11) 4-5 µm, sublimoniform, asymmetric in lateral view, verrucose, pale orange brown to yellowish in KOH, inamyloid, thin walled. Basidia (22-) 28-30 (-32) x 8-10 µm, clavate, 4-spored, hyaline. Pleurocystidia absent. Cheilocystidia 20-28 (-30) x 5-6 (-7) µm, common, capitate, ventricose to subventricose with a long and thin neck, capitulum 1-2 µm wide, hyaline, thin walled. Epicutis of hyphae 2-4 µm wide, gelatinized, hyaline, thin walled; subcutis of hyphae 3-4 µm wide, yellowish brown, incrusted, thin walled. Pileus trama with hyphae 5-12 (-15) µm wide, hyaline, thin walled. Gil trama subregular with hyphae 5-10 µm wide, hyaline, thin walled. Clamp connections absent.

HABITAT. Solitary on humus, in *Pinus patula* Schl. & Cham. forests.

MATERIAL STUDIED. STATE OF VERACRUZ: Eastern Cofre de Perote region, Xico County, El Revolcadero, Villarreal 672 (XAL; NY) Bandala-Muñoz 1006 (XAL; MICH).

OBSERVATIONS. The distinctive colors and the pileus shape, as well as the cheilocystidia size and shape, define this species. Smith (1957) and Horak (1976-77)considered it a broader pileus size (30-60 mm wide), and they reported from Western U.S.A. in coniferous forests. Horak (1976-77) treated *P. sipei* Smith and *P. scatesiae* Smith & Trappe, both from the Western U.S.A., as synonymous to *P. californica*.

3. *Phaeocollybia christinae* (Fr.) Heim, Le Genre Inocybe,
p. 71, 1931, non sensu Heim 1930 (Bull. Soc.
Myc. Fr. 46, tab. XXXVIII)
=*P. laterarius* Smith, Brittonia 9: 205, 1957.
Figs. 7-10

Pileus 25-30 mm broad, conical to campanulate with an acute apex when young, the margin inrolled or plane, surface smooth, viscid, hygrophanous, cinnamon brown to orange brown or yellowish brown. Lamellae subadnexed, yellowish to light brown or ferruginous, crowded, margin whitish and smooth. Stipe 90-125 x 8-9 mm, buried into the ground nearly half its long, fusoid, gradually attenuated downward forming a pseudorhiza, concolorous with the pileus above and dark vinaceous towards the base, flexuous, fibrous, smooth. Context yellowish with superficial reddish tinges; odour farinaceous.

Spores (9-)11-12 x 4-5 µm, sublimoniform-fusoid in frontal view or asymmetric-globose in lateral view, verrucose to somewhat rugose, pale orange brown to yellowish in KOH, inamyloid, thin walled. Basidia 28-35 x (6-) 8-10 (-12) µm, clavate, 4 spored, hyaline. Pleurocystidia absent. Cheilocystidia (22-) 30-35 x (4-) 5-8 µm, common, clavate, subfilamentous or subventricose, sometimes with a medial septum present, hyaline, thin walled. Epicutis composed of hyphae (2-) 5-9 µm wide, gelatinized, hyaline, thin walled; subcutis of hyphae (4-) 5-9 µm wide, orange brown to reddish brown in KOH, incrusted,thin walled. Pileus trama with hyphae 5-10 (-12) µm wide, hyaline to yellowish, thin walled. Gill trama subregular with hyphae 3-8 (-10) µm wide, hyaline, thin walled. Clamp connections absent.

HABITAT. Gregarious on humus, in a *Pinus patula* Schl. & Cham. forest.

MATERIAL STUDIED. STATE OF VERACRUZ: Eastern Cofre de Perote region, Xico County, El Revolcadero, Montoya-Bello 213 (XAL; MICH).

OBSERVATIONS. Singer (1975; 1986) placed *P. christinae* in the section *Phaeocollybia* with *P. kauffmanii* (Smith) Sing., and distinguished this section by the cheilocystidia shape and spores over 6.5 µm. *P. christinae* is characterized by spore size, and distinctive colors and viscidity of the pileus. The Mexican material agrees well with the descriptions of Horak (1976-77), Moser (1983), Jacobson & Stridvall (1982-83), Labe (1982), Redhead & Malloch (1986) and Smith (1957) (in the latter as *P. laterarius* Smith). *P. christinae* (Fr.) Heim sensu Heim 1930 is a synonym of *P. jennyae* (Karst.) Heim according to Redhead & Malloch (1986), Horak (1976-77), Singer (1986) and Jacobson & Stridvall (1982-83). On the other hand, Smith (1957) reported *P. christinae* and *P. jennyae* as independent species, distinguishing the former by the gelatinized pileus cuticle, occasionally with thick walled cheilocystidia and spores nearly hyaline in KOH. These features apparently are not present in *P. christinae* according to the other authors. Moreover, Horak (1976-77) and Singer (1986) consider *P. laterarius* as a synonym of *P. christinae* Smith (1957), although these authors not discuss the status of *P. christinae* sensu Smith (1957). Horak (1977) and Redhead & Malloch (1986) considered *P. rufipes* Bigelow, Rhodora 65: 297, 1963, described from Maine, U.S.A. as a synonym of the species here discussed.

This is the first record of *P. christinae* from Mexico. Previous to this paper, the species was only known in Europe and U.S.A.

4. Phaeocollybia kauffmanii (Smith) Sing., Rev. Myc. 5: 11, 1940.
=Naucoria kauffmanii Smith, Mycologia 29: 52, 1937.
Figs. 11-14

Pileus (17-) 50-70 mm broad, conical to subcampanulate slightly acute in the apex, surface smooth, viscid,reddish to cinnamon becoming yellowish brown, hygrophanus, with an inrolled margin. Lamellae free to subadnexed, light brown to reddish brown, with smooth and whitish edges. Stipe (70-) 90-120 x (7-) 12-13 mm, frequently buried into the ground more than half its length, gradually tapering downward to a long pseudorhiza; concolorous with the pileus above, the pseudorhiza becoming dark vinaceous, somewhat bright, fibrous, subcartilaginous, sometimes faintly longitudinal striate. Context yellowish with reddish tinges, with odour slightly farinaceous.

Spores (8-) 9-10 x (4-) 5-7 µm sublimoniform or subellipsoid, verrucose, yellowish brown to yellowish orange in KOH, inamyloid, thin walled. Basidia (25-) 32-35 (-40) x (6-) 7-8 (-10) µm, clavate, 4-spored, hyaline. Pleurocystidia absent. Cheilocystidia 28-32 x 4.8-5.6 (-8) µm clavate, cylindric or subfilamentous, hyaline, thin walled, somewhat numerous and rather conspicuous. Epicutis of hyphae (3-) 4-6 µm wide, gelatinized, hyaline, thin walled; subcutis of hyphae (5-) 8-12 µm, orange brown in KOH, thin walled, incrusted. Pileus trama with hyphae (3-) 5-10 (-15) µm wide, hyaline, thin walled. Gill trama subregular, hyphae 3-10 µm wide, hyaline to yellowish, thin walled. Clamp connections absent.

HABITAT. Solitary or gregarious on humus, in Pinus forest.

MATERIAL STUDIED. STATE OF VERACRUZ: Cofre de Perote region, Ixhuacán de Los Reyes County, Los Laureles, Montoya-Bello 138-A (XAL). Xico County, El Revolcadero, Villarreal 918 (XAL). Los Gallos, Villarreal 970 (XAL).

OBSERVATIONS. P. kauffmanii apparently is the most common species of the genus in Mexico. It is distributed in Pinus and Abies forests (Guzmán, 1973; 1977), in the States of Hidalgo (Varela & Cifuentes, 1979; Frutis & Guzmán, 1983), Veracruz (Guzmán & Villarreal, 1984), Morelos

(López *et al.*, 1985) and Durango (Pérez-Silva & Aguirre-Acosta, 1985), nevertheless no descriptions of the Mexican collections have been made. The fruitbody colours, the distintive gelatinized pileus cuticle and the cheilocystidia shape characterize this species. The material studied agrees well with that of Smith (1957), Hesler (1949), Bigelow & Barr, 1966, and Horak (1976-77), but Bigelow & Barr reported spores 7.5-9 x 5.5-6 µm.

5. *Phaeocollybia lugubris* (Fr.) Heim, Le Genre Inocybe, p. 71, 1931.
=*P. spadicea* Smith, Britonia 9: 215, 1957.
Figs. 15 & 16

Pileus aproximately 40 mm broad, conical to subconvex-umbonate, with a rather acute apex, surface viscid,smooth, gray with olivaceous tinges to grayish brown or yellowish brown. Lamellae subadnexed, reddish brown to ferruginous, with whitish edge. Stipe approx. 120 x 8 mm, concolorous with the pileus, darkening towards the pseudorhiza,fusoid, smooth, cartilaginous, fibrous. Context yellowish,fibrous, with odour slightly farinaceous.

Spores 8.8-9.6 (-11.2) x 4.8-5.6 µm, sublimoniform in frontal view to subelliptical and asymmetrical in lateral view, verrucose, orange brown to yellowish brown in KOH, inamyloid, thin walled. Basidia 20-24 x 5-7 µm, clavate, 4-spored, hyaline in KOH. Pleurocystidia not observed. Cheilocystidia (28-) 32-34 x 1.6-3.2 (-4) µm, common, capitate, subcylindrical-ventricose, cylindric or subfiliform, capitulum 0.5-1 (-2) µm, wide, frequently forked, hyaline, thin walled. Epicutis composed of cylindrical hyphae 2.4 - 3.2 µm wide, gelatinized, hyaline, thin walled; subcutis of hyphae 3.2-4.8 µm wide, reddish brown to orange brown in KOH, thin walled, incrusted. Pileus trama with hyphae 4-5.6 (-6.4) µm wide, yellowish in KOH, thin walled. Gill trama subregular, hyphae 4-6.4 µm wide, thin walled. Clamp connections absent.

HABITAT. Solitary on humus, in *Abies religiosa* (H.B.K.) Schl. & Cham. forests.

MATERIAL STUDIED. STATE OF MORELOS: Lagunas de Zempoala, near the principal lake, Guzmán 3022-A (ENCB).

OBSERVATIONS. P. lugubris is mainly recognized by the distinctive cheilocystidia shape. The spore range in the Mexican material is slightly larger than that observed by Smith (1957) (7-9 or 7-9.5 µm), Horak (1976-77) (7.5-9.5 µm) and Jacobson & Stridvall (1982-83) [7.5-8.5 (-9.5) µm]. Regarding the pleurocystidia, these seem absent; Smith (1957) reported them as "rare to scattered and similar to the cheilocystidia" and the same in P. spadicea, but Smith & Trappe (1972) in their key wrote "Pleurocystidia absent, acattered to abundant" refering to P. lugubris. This species is also distributed throughout States of Hidalgo and Durango according to Frutis & Guzmán (1983) and Aguirre-Acosta & Pérez-Silva (1985), respectively.

Singer (1986) considered P. lugubris, P. californica, P. spoliata and P. mexicana under the section Versicolores Smith, defined by cheilocystidia shape, clamp conection absence, and spores larger than 6.5 µm.

6. Phaeocollybia mexicana Corner & Horak, in Horak,
Sydowia 29: 40, 1976-77.
Figs. 17-19

Pileus approximately 13-14 mm broad, subconical, more or less umbonate with a slightly inrolled margin, surface smooth, viscid, pale vinaceous, hygrophanous, gradually fading to gray brown. Lamellae subadnexed, ferruginous to reddish brown, crowded. Stipe approx. 50-70 x 3-4 mm, cylindrical, fusoid, buried into the ground less than half its length, polished, concolorous with the pileus, smooth, flexuous, fibrous, with a short pseudorhiza. Context whitish, slightly staining reddish, odour farinaceous.

Spores 7.2-8.8 (-10.4) x 3.2-4.8 µm, sublimoniform to subellipsoid, verrucose, orange brown to yellowish in KOH, inamyloid, thin walled. Basidia 22-28 (-32) x 6-8 µm, clavate, 4-spored, hyaline. Pleurocystidia absent. Cheilocystidia 16-24.8 (-28) x 1.6-2.4 (-3.2) µm, capitate, filamentous or subventricose, capitulum 0.8-1.6 µm wide, hyaline, thin walled, numerous. Epicutis composed of cylindrical hyphae 2.4-3.2 (-4) µm wide, gelatinized, hyaline, thin walled; subcutis of hyphae 5-6 (-7.2) µm wide, orange brown, incrusted thin walled. Pileus trama with hyphae 4-7 µm wide, hyaline to yellowish, thin walled. Gill trama subregular, hyphae 4.8-5.6 µm wide, hyaline to grayish yellow,thin walled. Clamp connections absent.

HABITAT. Solitary on humus, in *Pinus* forest.

MATERIAL STUDIED. STATE OF VERACRUZ: Western Cofre de Perote region, Ixhuacán de Los Reyes County, Los Laureles, Bandala-Muñoz 172 (XAL).

OBSERVATIONS. *P. mexicana* was described by Corner and Horak (in Horak, 1976-77) from the Desierto de Los Leones, Distrito Federal (close to Mexico City). The species is distinguished by the filamentous-capitate cheilocystidia and the small fruitbody. Corner & Horak mentioned a broader variation of the pileus colors ("tawny brown to fuscous brown, drying light ferruginous"), a wider spores range (8.5-10 x 5-5.5 µm), and the occurrence of a lateral and basal spore plaque.

7. *Phaeocollybia spoliata* Horak, Acta Bot. Indica 2: 72, 1974.
Figs. 20-22

Pileus (15-) 20-40 (-50) mm broad, conical to campanulate-subumbonate with an inrolled or plane margin, surface smooth, viscid, pale orange brown with reddish tinges, becoming vinaceous brown or yellowish brown. Lamellae adenexed to almost free, yellowish to yellowish brown or ferruginous with whitish edges. Stipe (80-) 95-145 x (3-) 6-7 (-11) mm, buried into the ground nearly half its length, fusoid, gradually tapering downward in a long pseudorhiza; concolorous with the pileus but the pseudorhiza becoming dark vinaceous, smooth, subcartilaginous to slightly fleshy, but fibrous. Context white yellowish, slowly turning reddish on exposure; odour and taste farinaceous.

Spores (9-) 10-11 (-12) x 4-6 (-7) µm, sublimoniform to subellipsoid, verrucose, light brown in mass, orange brown in KOH, inamyloid, thin walled. Basidia (25-) 30-35 x (6-) 7-9 µm, clavate, 4-spored, hyaline in KOH. Pleurocystidia absent. Cheilocystidia (17-) 20-30 x (2-) 4-8 µm, sublageniform or ventricose-fusoid, capitate or rostrate, capitulum 5-6 µm broad, hyaline, thin walled, numerous. Epicutis composed of cylindrical hyphae 2-4 (-5) µm wide, gelatinized, hyaline to yellowish, thin walled. Subcutis of hyphae (4-) 5-9 µm wide, light to dark orange brown, thin walled and with incrustations. Pileus trama with hyphae (2-) 4-10 µm wide, hyaline to yellowish, thin walled. Gill trama subregular, hyphae (2-) 3-6 µm wide, hyaline, mixed with some orange brown hyphae, thin walled. Clamp connections absent.

HABITAT. Solitary or gregarious on humus, in *Pinus* and *Pinus*-*Abies* forests.

MATERIAL STUDIED. STATE OF VERACRUZ: Eastern Cofre de Perote region, Xico County, El Revolcadero, Bandala-Muñoz 244 (XAL; MICH), 1007 (XAL; NY). Los Gallos, Bandala-Muñoz 362 (XAL).

OBSERVATIONS. This species is well defined by the cheilocystidia shape, with a capitulum more than 4 µm wide and for the spore size. Horak (1974; 1976-77) described a spore plaque not observed in Mexican collections. This species is close to *P. kauffmanii* (Smith) Sing. and *P. christinae* (Fr.) Heim, which differ by clavate cheilocystidia. Previous to this report, this species was only known from India, growing in *Pinus*-*Picea* forests (Horak, 1974) and *Pinus*-*Abies* forests (Horak, 1976-77).

ACKNOWLEDGEMENTS

The authors gratefully acknowledge the financial support from CONACYT. They also appreciate the help of Biologist Ricardo Valenzuela from Herbarium ENCB for specimen loans; Biologist Luis Villarreal from INIREB for his collaboration in the field. Dr. Andrew Vovides and Technician Carlos Iglesias, both from INIREB kindly gave photomicroscopic facilities. This paper was kindly revised by Dr. J.H. Ginns and Dr. S.A. Redhead, both from the Biosystematics Research Centre, at Canada, and by Dr. A. Vovides which the authors highly appreciate.

LITERATURE CITED

Bigelow, H.E. and M.E. Barr, 1963. Contribution to the fungus flora of Northeastern North America, IV. Rhodora 68: 175-191.

Farr, D.F. and E.R. Farr, 1976. Notes on *Phaeocollybia* and *Pholiota* in the Southern Appalachians. In: The Distributional History of the Biota of the Southern Appalachians, Part IV. Algae and Fungi. Ed. B.C. Parker & M. K. Roane, University Press of Virginia, Charlottesville.

Frutis, I. and G. Guzmán, 1984. Contribución al conocimiento de los hongos del Estado de Hidalgo. Bol. Soc. Mex. Mic. 18: 219-265.

Guzmán, G., 1973. Some distributional relationships between Mexican and United States micofloras. Mycologia 65: 1319-1330.

Guzmán, G., 1977. Identificación de los hongos comestibles, venenosos y alucinógenos. Ed. Limusa, Mexico City.

Guzmán, G. and L. Villarreal, 1984. Estudios sobre los hongos, líquenes y mixomicetos del Cofre de Perote, Veracruz, I. Introducción a la micoflora de la región, Bol. Soc. Mex. Mic. 19: 107-124.

Hesler, L.R., 1949. Notes on Southern Appalachian fungi, VIII. Jour. Tenn. Acad. Sci. 24: 81-93.

Horak, E., 1974. Two new species of *Phaeocollybia* (Agaricales, Fungi) from India. Acta Bot. Indica 2: 69-73.

Horak, E., 1976-77. Further additions towards a monograph of *Phaeocollybia*. Sydowia 29: 28-70.

Jacobson, S. and S. Stridvall, 1982-83. Släktet *Phaeocollybia* i Sverige. Windahlia 12-13: 57-59.

Laber, D., 1982. Die europälschen Arten der Gattung *Phaeocollybia* (Wurzelschnitzlinge) und ihr Vorkommen in südlichen Schworzwald. Zeits. Mycol. 48: 89-98.

López, L., V.M. Mora, E. Montiel and G. Guzmán, 1985. Nuevos registros de los Agaricales del Estado de Morelos. Rev. Mex. Mic. 1: 269-284.

Moser, M., 1983. Keys to agarics and boleti (poliporales, boletales, agaricales, russulales). Roger Phillips, London.

Pérez-Silva, E. and E. Aguirre-Acosta, 1985. Micoflora del Estado de Durango, México. Rev. Mex. Mic. 1: 315-329.

Redhead, S.A. and D.W. Malloch, 1986. The genus *Phaeocollybia* (Agaricales) in eastern Canada and its biological status. Canada Jour. Bot. 64: 1249-1254.

Singer, R., 1957. Fungi mexicani, series prima. Agaricales. Sydowia 11: 354-374.

Singer, R., 1970. Phaeocollybia(Cortinariaceae-Basidiomycetes). Flora Neotropica 4: 1-13.

Singer, R., 1975. Agaricales in moder taxonomy. Cramer, Vaduz (3th ed.).

Singer, R., 1986. Agaricales in modern taxonomy. Koeltz Scient. Books, Koenigstein (4th ed.).

Smith, A.H., 1957. A contribution toward a monograph of Phaeocollybia. Brittonia 9: 195-217.

Smith, A.H. and J.M. Trappe, 1972. The higher fungi of Oregon's Cascade Head Experimental Forest and vicinity, I. The genus Phaeocollybia (Agaricales) and notes and descriptions of other species in the Agaricales. Mycologia 64: 1138-1153.

Varela, L. and J. Cifuentes, 1979. Distribución de algunos macromicetos del Estado de Hidalgo. Bol. Soc. Mex. Mic. 13: 75-88.

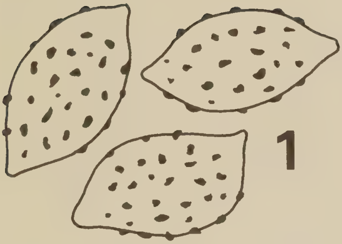
FIGURES

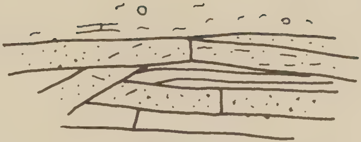
Figs. 1-7.- 1-3: Phaeocollybia attenuata ssp. attenuata, 1: spores; 2: pileus cuticle; 3: cheilocystidia. 4-6: Phaeocollybia californica, 4: cheilocystidia; 5: pileus cuticle; 6: spores. 7: Phaeocollybia christinae, spores.

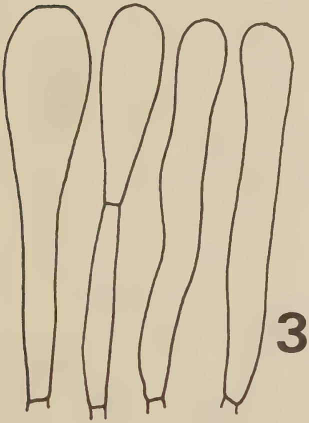
Figs. 8-12.- 8-10: Phaeocollybia christinae, 8: basidiocarp; 9: cheilocystidia; 10: pileus citicle. 11-12: Phaeocollybia kauffmanii, 11: spores; 12: pileus cuticle.

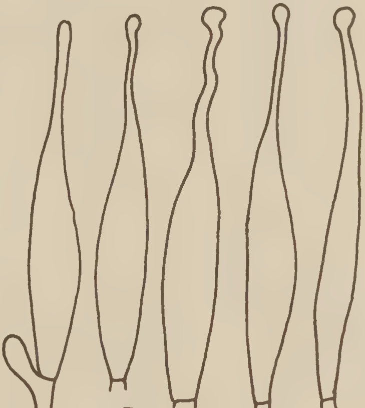
Figs. 13-17.- 13-14: Phaeocollybia kauffmanii, 13: basidiocarp; 14: cheilocystidia. 15-16: Phaeocollybia lugubris, 15: spores; 16: cheilocystidia. 17: Phaeocollybia mexicana, spores.

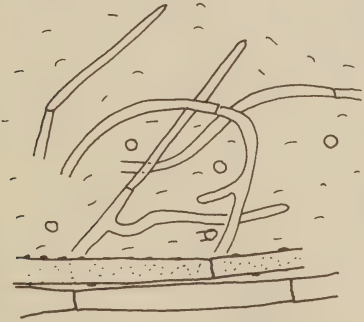
Figs. 18-22.- 18-19: Phaeocollybia mexicana, 18: cheilocystidia; 19: basidiocarp. 20-22: Phaeocollybia spoliata, 20: basidiocarp; 21: spores, 22: cheilocystidia.

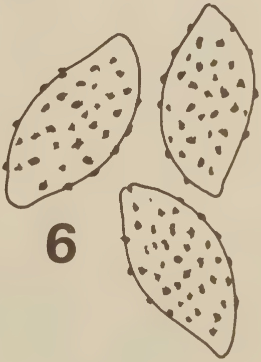

1

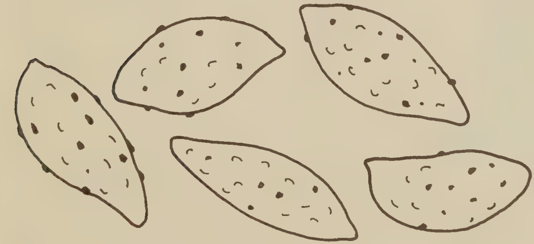

2

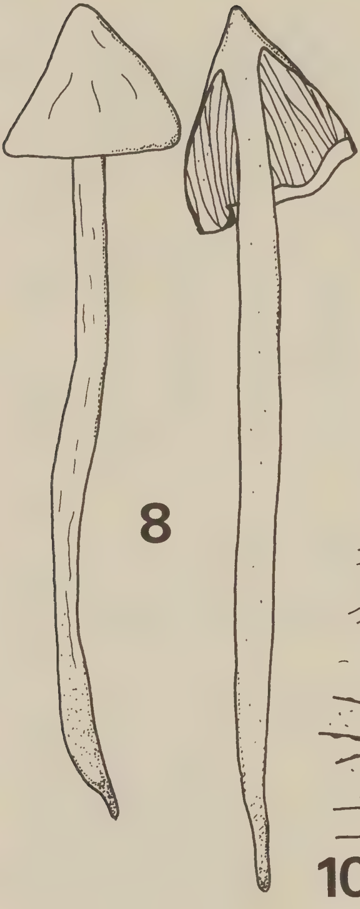

3


4

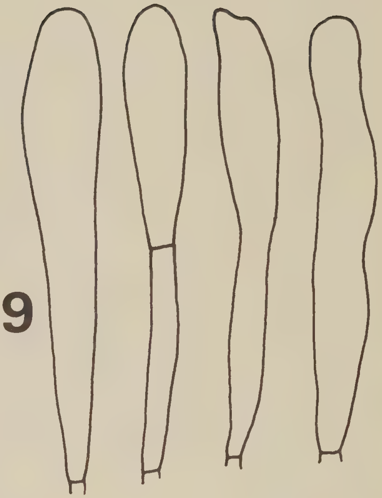

5


6

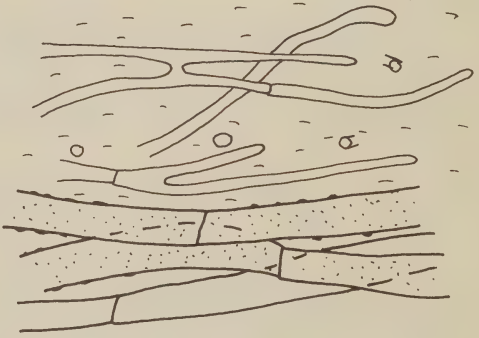

7



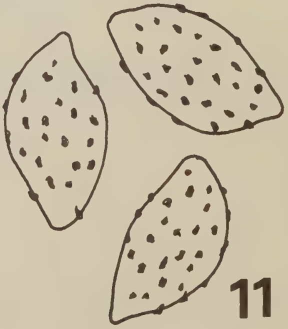
8



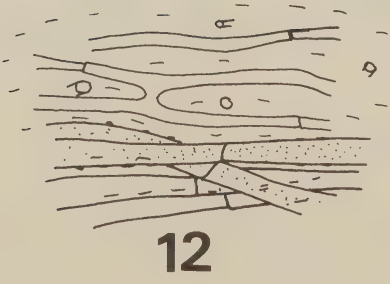
9



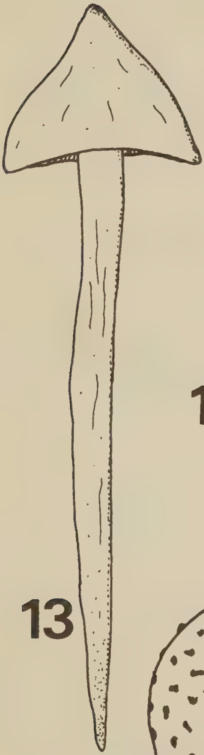
10



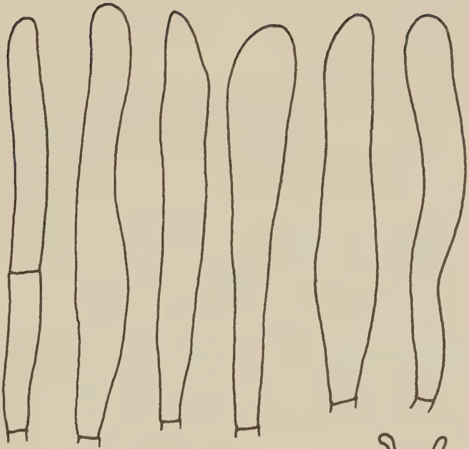
11



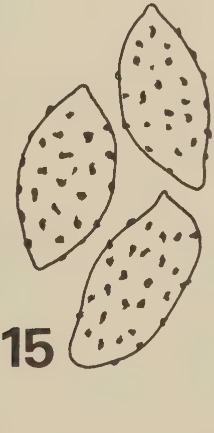
12



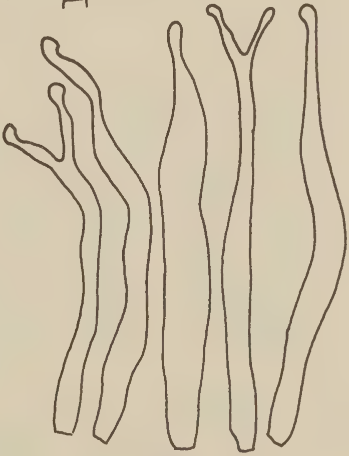
13



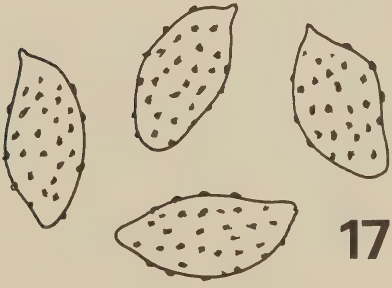
14



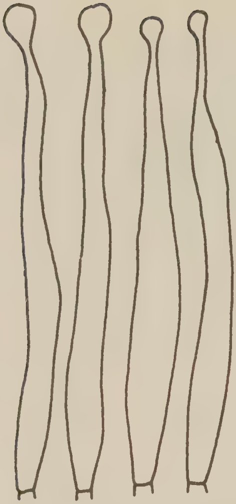
15



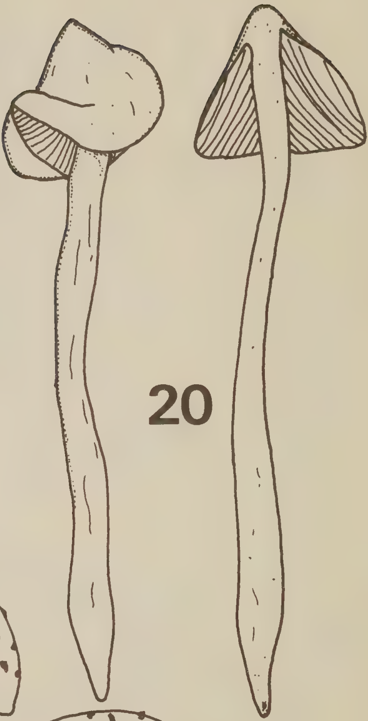
16



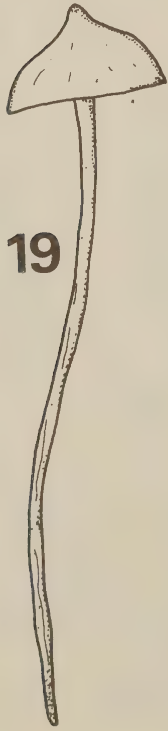
17



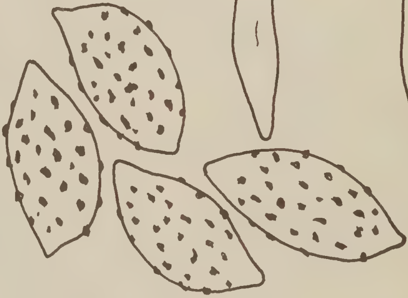
18



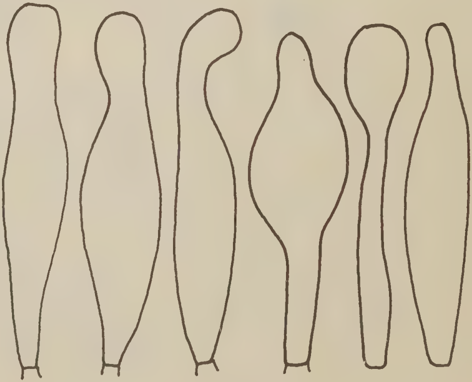
20



19



21



22

MYCOTAXON

Vol. XXX, pp. 239-246 October-December 1987

STUDIES IN THE GENUS PHOMA. IX. CONCERNING PHOMA JOLYANA

GARETH MORGAN-JONES and KATHERINE B. BURCH

Department of Plant Pathology, College of Agriculture and Alabama Agricultural Experiment Station, Auburn University, Auburn, Alabama 36849

ABSTRACT

Phoma jolyana Pirozynski & Morgan-Jones [= *Phoma musae* (Joly) Boerema, Dorenbosch & van Kesteren] is described and illustrated. Details of its morphology and cultural characteristics *in vitro*, and of its pycnidial wall anatomy are provided.

INTRODUCTION

Of the seven species of *Phoma* Sacc. presently known to form dictyochlamydospores, four, namely *P. americana* Morgan-Jones & White, *P. glomerata* (Cda) Wollenw. & Hochapf., *P. pomorum* Thüm., and *P. sorghina* (Sacc.) Boerema, Dorenbosch & van Kesteren, have previously been treated in this series of papers (Morgan-Jones and White, 1983; White and Morgan-Jones, 1983, 1986, 1987). The latter three species, as well as the subject of the present paper, *P. jolyana*, comprise a group formerly classified in *Peyronellaea* Goidãnich on the basis of production of chlamydospores that morphologically resemble conidia of *Alternaria* Nees. Boerema *et al.* (1965), stressing the similarity between the pycnidia of these fungi and those of *Phoma herbarum* Westd., the type species of *Phoma*, maintained that they should be classified in that genus although possessing dictyochlamydospores of unique morphology. This opinion has subsequently been followed by Morgan-Jones (1967), Sutton (1980) and White and Morgan-Jones (1983, 1986, 1987).

Phoma jolyana was first described under the name *Peyronellaea musae* Joly (Joly, 1961) and later the same year Tandon and Bilgrami (1961) established the binomial *Peyronellaea nainensis* for it (Joly's name dates from July 1961, Tandon and Bilgrami's from December 1961). Boerema *et al.* (1965) transferred *Peyronellaea musae* into *Phoma*, as *Phoma musae* (Joly) Boerema, Dorenbosch & van Kesteren, but in so doing inadvertently created a later homonym of *Phoma musae* (Cke) Sacc. (*Syll. Fung.* 3: 163, 1884). The name *Phoma musae* Carpenter (*Rep. Hawaii agric. Exp. Stn* 1918: 39, 1919), established for the causal organism of banana freckle disease, is another homonym of *P. musae* (Cke) Sacc. [The presently accepted name for that fungus is *Phyllosticta musarum* (Cke) van der Aa (basionym, *Sphaeropsis musarum* Cke; teleomorph, *Guignardia musae* Raciborski).] Recognizing the illegitimate nature of the name *P. musae* (Joly) Boerema, Dorenbosch & van

---

Alabama Agricultural Experiment Station Journal Series No. 18-871287

Kesteren, Pirozynski and Morgan-Jones (1968) proposed the *nomen novum Phoma jolyana* Pirozynski & Morgan-Jones, in honor of Dr. Patrick Joly, for the fungus. A new combination based on *Peyronellaea nainensis* could not be made since this would create a homonym of the previously published *Phoma nainensis* [as *nainense*] Bilgrami (*Curr. Sci.* 32: 175, 1963). Morelet (1968) took similar action to that of Pirozynski and Morgan-Jones by establishing the *nomen novum Phoma jolyi* Morelet. Since *P. jolyana* predates *P. jolyi* by being published in a preceding month (June 1968 as opposed to July 1968) [Morelet in litt., fide Boerema *et al.* (1973)], it has priority.

Kuznetzova (1971) described six species of *Peyronellaea* from collections made in the botanical garden at Novosibirsk, U.S.S.R. Following examination of type cultures of these, Boerema *et al.* (1977) considered two of them, *P. circinata* Kuznetz. and *P. nigricans* Kuznetz., to be essentially the same as *P. jolyana*. Three others, *P. ruptilis* Kuznetz., *P. sibirica* Kuznetz., and *P. zhdanovii* (as *zhdanovi*) Kuznetz., were found to be phenotypic variants of *Phoma glomerata* and the remaining species, *P. stemphylioides* Kuznetz., was determined to be *Phoma sorghina*. The two isolates of *P. jolyana* were reported to form dictyochlamydospores more abundantly and their conidia to be more irregular in shape than is normal for the species. For this reason, *P. circinata* (which has page priority over *P. nigricans*) was transferred into *P. jolyana* as a variety [*P. jolyana* var. *circinata* (Kuznetz.) Boerema, Dorenbosch & van Kesteren] and *P. nigricans* listed as a synonym of it. By so doing, *P. jolyana* var. *jolyana* was automatically created. Sutton (1980), pointing out that the whole complex is somewhat variable, expressed the view that the characteristics used to differentiate var. *circinata* are rather difficult to apply in identification. Conidial shape in *P. jolyana* is almost always somewhat irregular. Boerema *et al.* (1965) noted that isolates of this species vary in their characteristics, which are influenced by age of cultures and culture medium. It seems doubtful that var. *circinata* can be recognized with consistency.

Phoma jolyana has been reported from a range of substrates and seems to be predominantly tropical or subtropical in its distribution. It is probably, as are *P. glomerata* and *P. pomorum*, a secondary invader of diseased plant tissue although it has been reported to cause a leaf-spot disease of *Eriobotrya japonica* (Thunb.) Lindl. [loquat] in India (Boerema *et al.*, 1965). Its host range also includes *Mangifera indica* L. [mango], *Musa* sp. [banana], and *Oryza sativa* L. [rice] (Boerema *et al.*, 1971). We have had opportunity to examine several isolates of it, including the type cultures of *P. circinata* and *P. nigricans*.

MATERIALS AND METHODS

Isolates ATCC 48111 and CBS 285.76/286.76 (for particulars see collections examined) were grown on potato dextrose agar and, following conidiation, a number of monoconidial subisolates were prepared. Colony characteristics and radial growth rates were determined on potato dextrose, malt extract, and cellulose agars, incubated at three temperatures (20, 25 and 30C) in the dark. Four replicate plates, each inoculated with a single 7-mm-diameter agar disk cut from the periphery of an actively growing 7-day-old colony on PDA, were used.

Vertical sections of pycnidia from a dried colony of the *Eriobotrya* isolate on oatmeal agar (provided by Dr. G.H. Boerema) were obtained using a Sorvall ® microtome following fixation in a solution of 3% glutaraldehyde and

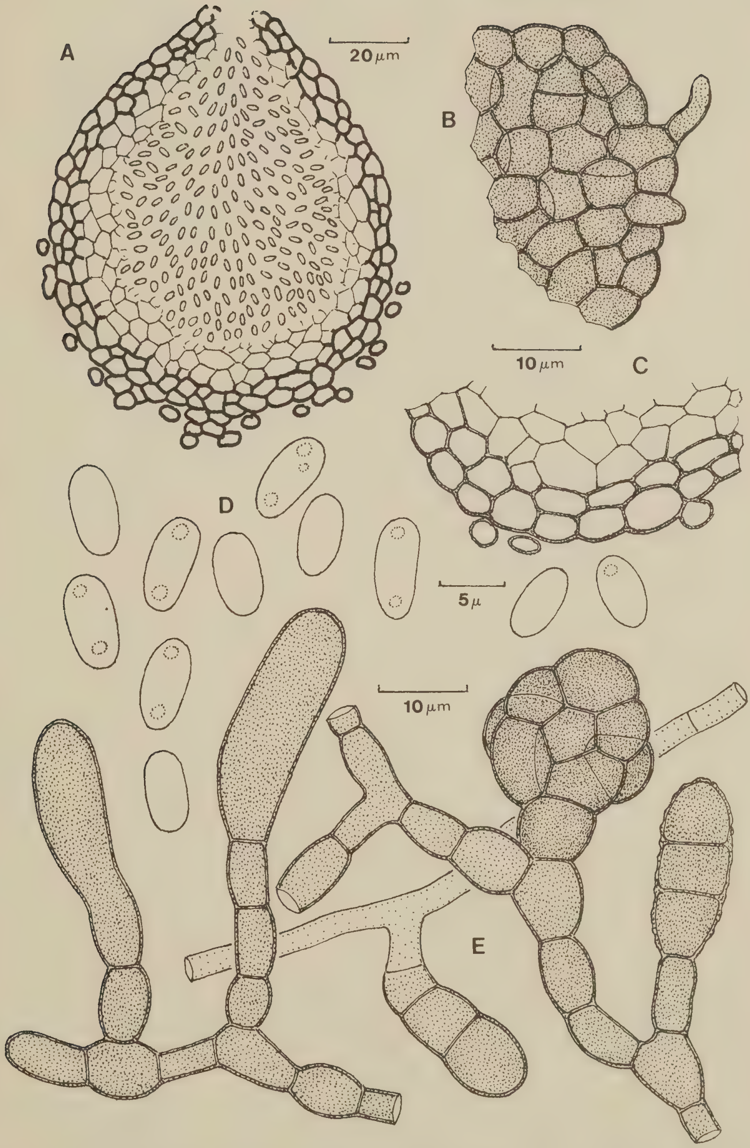

A
20μm
B
10μm
C
D
5μ
10μm
E

FIGURE 1. *Phoma jolyana*. (*Eriobotrya* isolate). A, V.S. pycnidium; B & C, portions of pycnidial wall (B, surface view, C, in section); D, conidia; E, chlamydospores.

0.05 M phosphate buffer at pH 7.0, dehydration through an ethanol series, and embedding in JB-4® plastic medium [Polysciences, Inc., Warrington, PA].

TAXONOMIC PART

Phoma jolyana Pirozynski & Morgan-Jones, *Trans. Br. mycol. Soc.* 51: 200, 1968 (Plate 1, figures 1 and 2).

= *Peyronellaea musae* Joly, *Rev. Mycol.* 26: 97, 1961.

≡ *Phoma musae* (Joly) Boerema, Dorenbosch & van Kesteren, *Persoonia* 4: 63, 1965: non *P. musae* (Cke) Sacc.; non *P. musae* Carpenter.

= *Peyronellaea nainensis* Tandon & Bilgrami, *Curr. Sci.* 30: 344, 1961.

= *Phoma jolyi* Morelet, *Bull. Soc. Sci. nat. Archeol. Toulon* Var 177: 9, 1968.

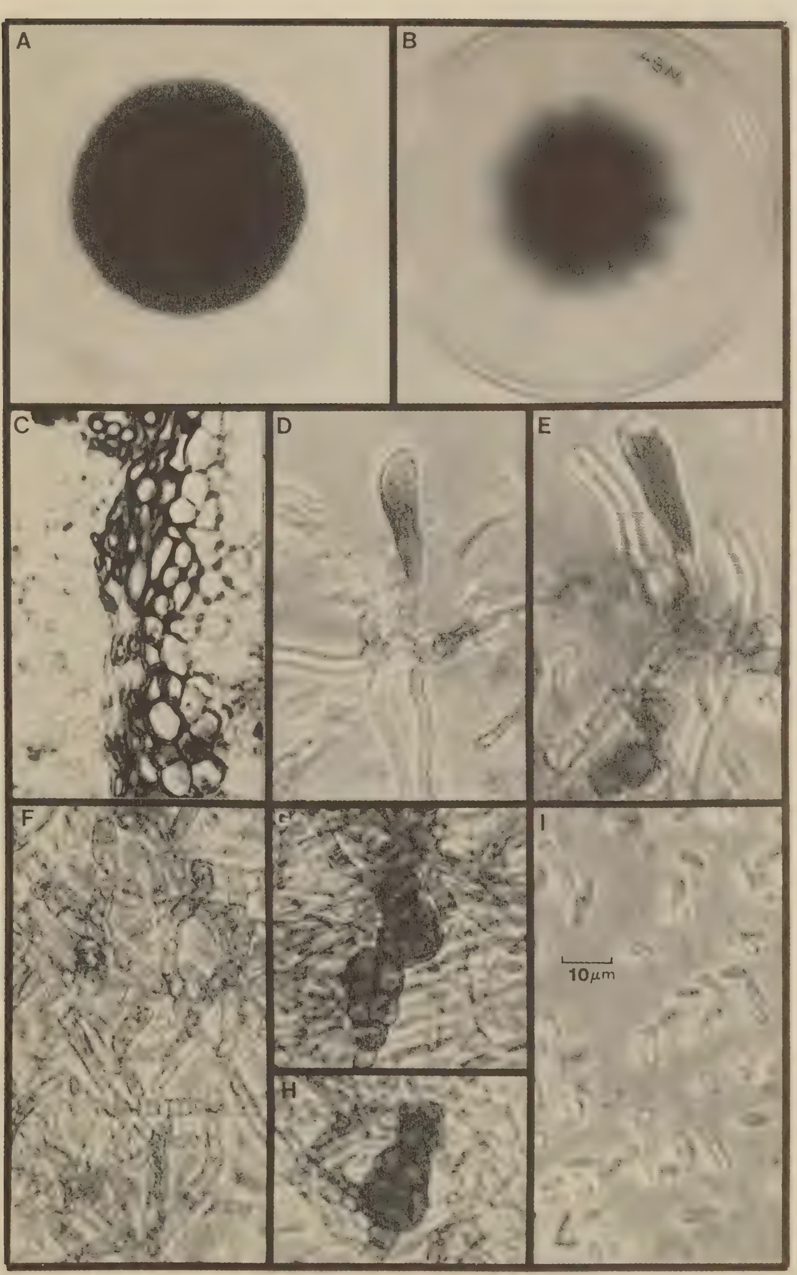
= *Peyronellaea circinata* Kuznetz., *Nov. Sist. Nas. Ras.* 8: 189, 1971.

≡ *Phoma jolyana* Pirozynski & Morgan-Jones, var. *circinata* (Kuznetz.) Boerema, Dorenbosch & van Kesteren, *Kew Bull.* 31: 535, 1977.

= *Peyronellaea nigricans* Kuznetz., *Nov. Sist. Nas. Ras.* 8: 191, 1971.

Colonies on potato dextrose agar [Difco] somewhat variable in color between isolates, ranging from pale grayish olivaceous to charcoal gray to black, individual isolates generally rather uniform in color except at the extreme margin where a 3-4 mm wide, pale buff zone is usually present, sometimes with a 6-7 mm wide, paler zone between the marginal zone and a central darker portion, paler stains occasionally producing one or more dark sectors, felted, in some isolates dense and with the surface becoming fissured after 14 days, attaining a diameter of 45 mm at 20C after 7 days, 52-60 mm (radial growth varies between strains) at 25C, with no growth at 30C; periphery of colonies generally even but in the type isolate of *P. nigricans* (CBS 286.76), which also grows appreciably slower than other isolates (44 mm at 25C after 7 days), colonies are lobed in appearance. Reverse black. Colonies on malt extract agar [Difco] olivaceous brown,with very little aerial mycelium, radially striated, attaining a diameter of 42 mm at 20C after 7 days, 50 mm at 25C (CBS 286.76, 43 mm), with no growth at 30C. Colonies on cellulose agar (Morgan-Jones and White, 1983) sparse, with little aerial mycelium, attaining a diameter of 43 mm at 20C after 7 days, 45 mm at 25C (CBS 286.76, 36 mm), with no growth at 30C. Mycelium composed of two types of hyphae; subhyaline, septate, cylindrical, smooth, 2-3 µm wide and pale to mid brown, closely septate (septa 8-14 µm apart), slightly constricted at the septa, abundantly branched, smooth, with

PLATE 1. *Phoma jolyana*. A, 7-day-old colony on PDA at 25C (CBS 285.76); B, same on MEA; C, portion of pycnidial wall in section; D & E, chlamydospore initials; F, hyphae; G & H, chlamydospores; I, conidia (CBS 285.76).


A
B
C
D
E
F
G
H
I
10 μm

individual cellular elements sometimes slightly inflated, 3.5-6 µm wide. Pycnidia produced abundantly on PDA and cellulose agar but not on MEA, solitary, scattered or gregarious, occasionally coalescing, superficial or partly immersed, subglobose to obpyriform, without a pronounced neck, mostly uniostiolate, black, 150-200 µm in diameter. Pycnidial wall 4 to 6 cells thick, 10-18 µm wide, composed of two types of cells; an outer layer of thick-walled, mid-brown, subglobose to ellipsoid, 4.5-5.5 µm in diameter cells and an inner layer of thin-walled, subhyaline, distinctly angular cells (textura angularis), of similar or somewhat smaller size, lining the venter. Conidiogenous cells monophialidic, determinate, hyaline, smooth, ampulliform, borne on the inner cells of the pycnidial wall. Conidia enteroblastic, hyaline, smooth, aseptate, variable in shape, ellipsoid to obovoid or oblong with obtuse ends to somewhat allantoid, 5-10 X 3-4 µm. Dictyochlamydospores variable in shape and size, formed terminally or, more rarely, intercalarily, often as terminal elements of short lateral branches, sometimes becoming lateral through continued growth of a constituent cell, usually single but sometimes in irregular clusters, broadly clavate to obovoid, smooth or irregularly roughened, transversely, longitudinally and obliquely septate, constricted where septa meet periclinal wall, 14-45 X 9-20 µm; produced abundantly on all media, both aerially and immersed. On MEA chlamydospores mostly immersed.

Plurivorous; cosmopolitan

Collections examined: isolated from *Eriobotrya japonica*, Allahabad, India, R.N. Tandon (type culture of *P. nainensis*), PD ; isolated from *Erythrina variegata* L., Mangiloa, Guam, V.M. Russo, ATCC 48111 (as *Phoma musae*) [received at Rockville, October 22, 1982]; isolated from *Heracleum dissectum* Ledeb., and *Allium nutans* L., Botanical Garden, Novosibirsk, U.S.S.R., T.T. Kuznetzova, CBS 285.76 and 286.76 (type cultures of *P. circinata* and *P. nigricans*, respectively).

The dense, felted mycelial mat and abundant chlamydospores produced on PDA are notable features of *P. jolyana*, especially the Russian isolates. Immature chlamydospores have a distinctive appearance, frequently being broadly club-shaped before any transverse or longitudinal septa are formed. At this, or a slightly later stage of development, the wall often appears to be roughened.

Individual subisolates of CBS 285.76 (type of *P. circinata* [≡ *P. jolyana* var. *circinata*]) vary in colony coloration on PDA, some after 7 days being much darker than others. All subisolates of this strain, however, have the characteristics of producing abundant chlamydospores and variously shaped conidia. Conidia of the *Eriobotrya* isolate were found to have a much more consistent shape.

The pycnidial wall anatomy of *P. jolyana* is quite different from that of the other dictyochlamydospore-bearing species of *Phoma* described previously. The inner, textura angularis wall layer is a particular distinctive feature. The other two species that might conceivably be sometimes confused with *P. jolyana*, namely *P. glomerata* and *P. pomorum*, have equally characteristic pycnidial wall anatomies. The wall of *P. glomerata* is notable among those of the many species of *Phoma* examined in having extensive extracellular darkly-pigmented deposits between constituent cells (White and Morgan-Jones, 1987). The pycnidial wall of *P. pomorum* is narrower than those of either *P.*

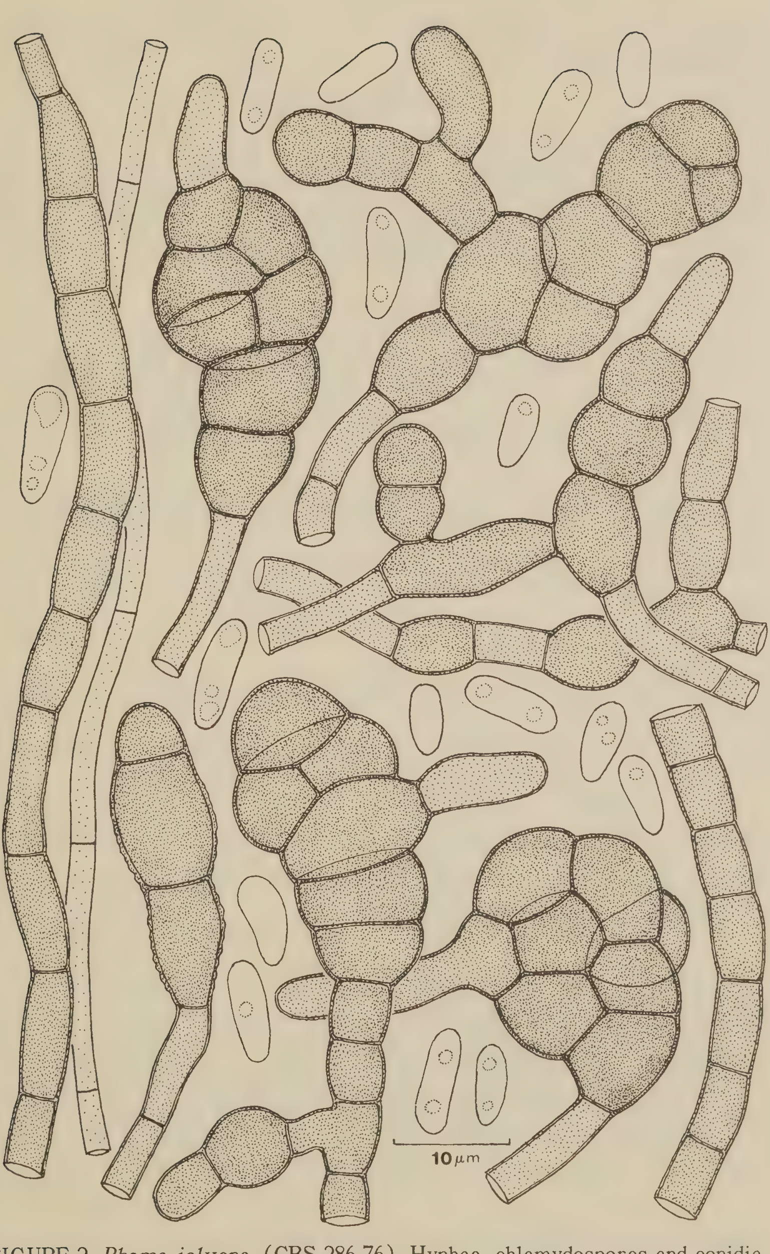


FIGURE 2. *Phoma jolyana*. (CBS 286.76). Hyphae, chlamydospores and conidia.

glomerata or *P. jolyana* and composed of elongate cells (White and Morgan-Jones, 1986).

ACKNOWLEDGMENTS

We are grateful to Dr. G.H. Boerema, Plantenziektenkundige Dienst, Wageningen, The Netherlands, for providing us with a dried culture of the *P. nainensis* type isolate. Dr. G.S. de Hoog, Centraalbureau voor Schimmelcultures, Baarn, kindly arranged for us to receive cultures of the type isolates of *P. circinata* and *P. nigricans*. The manuscript was reviewed by Dr. J. Leland Crane, Illinois Natural History Survey Division.

LITERATURE CITED

BOEREMA, G.H., M.M.J. DORENBOSCH, and H.A. VAN KESTEREN. 1965. Remarks on species of *Phoma* referred to *Peyronellaea*. *Persoonia* 4: 47-68.

BOEREMA, G.H., M.M.J. DORENBOSCH, and H.A. VAN KESTEREN. 1971. Remarks on species of *Phoma* referred to *Peyronellaea*. III. *Persoonia* 6: 171-177.

BOEREMA, G.H., M.M.J. DORENBOSCH, and H.A. VAN KESTEREN. 1973. Remarks on species of *Phoma* referred to *Peyronellaea*. IV. *Persoonia* 7: 131-139.

BOEREMA, G.H., M.M.J. DORENBOSCH, and H.A. VAN KESTEREN. 1977. Remarks on species of *Phoma* referred to *Peyronellaea*. V. Kew Bull. 31: 533-544.

JOLY, P. 1961. Espēces nouvelles ou intēressantes de la flore des bananes. *Rev. Mycol.* 26: 89-99.

KUZNETZOVA, T.T. 1971. Novye vidy roda *Peyronellaea* Goid. ex Togl. v ēpifitnoï mikoflore nekotorykh rasteniï *Nov. Sist. Niz. Rast.* 8: 188-201.

MORELET, M. 1968. De Aliquibus in Mycologia Novitatibus (3 note). *Bull. Soc. Sci. nat. Archēol. Toulon Var* 177: 9.

MORGAN-JONES, G. 1967. CMI Descriptions of Pathogenic Fungi and Bacteria, nos 134, 135.

MORGAN-JONES, G. and J.F. WHITE. 1983. Studies in the genus *Phoma*. I. *Phoma americana* sp. nov. *Mycotaxon* 16: 403-413.

PIROZYNSKI, K.A. and G. MORGAN-JONES. 1968. Notes on Microfungi III. *Trans. Br. mycol. Soc.* 51: 185-206.

SUTTON, B.C. 1980. The Coelomycetes. Commonwealth Mycological Institute. 696 pp.

TANDON, R.N. and K.S. BILGRAMI. 1961. A new species of *Peyronellaea* Goid. *Curr. Sci.* 30: 343-344.

WHITE, J.F. and G. MORGAN-JONES. 1983. Studies in the genus *Phoma*. II. Concerning *Phoma sorghina*. *Mycotaxon* 18: 5-13.

WHITE, J.F. and G. MORGAN-JONES. 1986. Studies in the genus *Phoma*. V. Concerning *Phoma pomorum*. *Mycotaxon* 25: 461-466.

WHITE, J.F., JR. and G. MORGAN-JONES. 1987. Studies in the genus *Phoma*. VII. Concerning *Phoma glomerata*. *Mycotaxon* 28: 437-445.

MYCOTAXON

Vol. XXX, pp. 247-252 October-December 1987

DISSITIMURUS, A NEW DEMATIACEOUS GENUS OF HYPHOMYCETES

EMORY G. SIMMONS
Wabash College
Crawfordsville, Indiana 47933

MICHAEL R. McGINNIS
Department of Microbiology and Immunology
University of North Carolina
Chapel Hill, North Carolina 27514

MICHAEL G. RINALDI
Department of Pathology
University of Texas Health Science Center at San Antonio
and
Clinical Microbiology Laboratories
Audie L. Murphy Memorial Veterans' Hospital
San Antonio, Texas 78284

Dissitimurus exedrus Simmons, McGinnis & Rinaldi, sp. nov., type of a new genus, is described from isolates of a fungus from human nasopharynx and turbinate lesions.

DISSITIMURUS Simmons, McGinnis & Rinaldi Fig. 1-5

Etym.: *dissitus* (apart, spaced) + *murus* (wall), with reference to the disjunct nature of the outer walls of otherwise contiguous spore-chain elements.

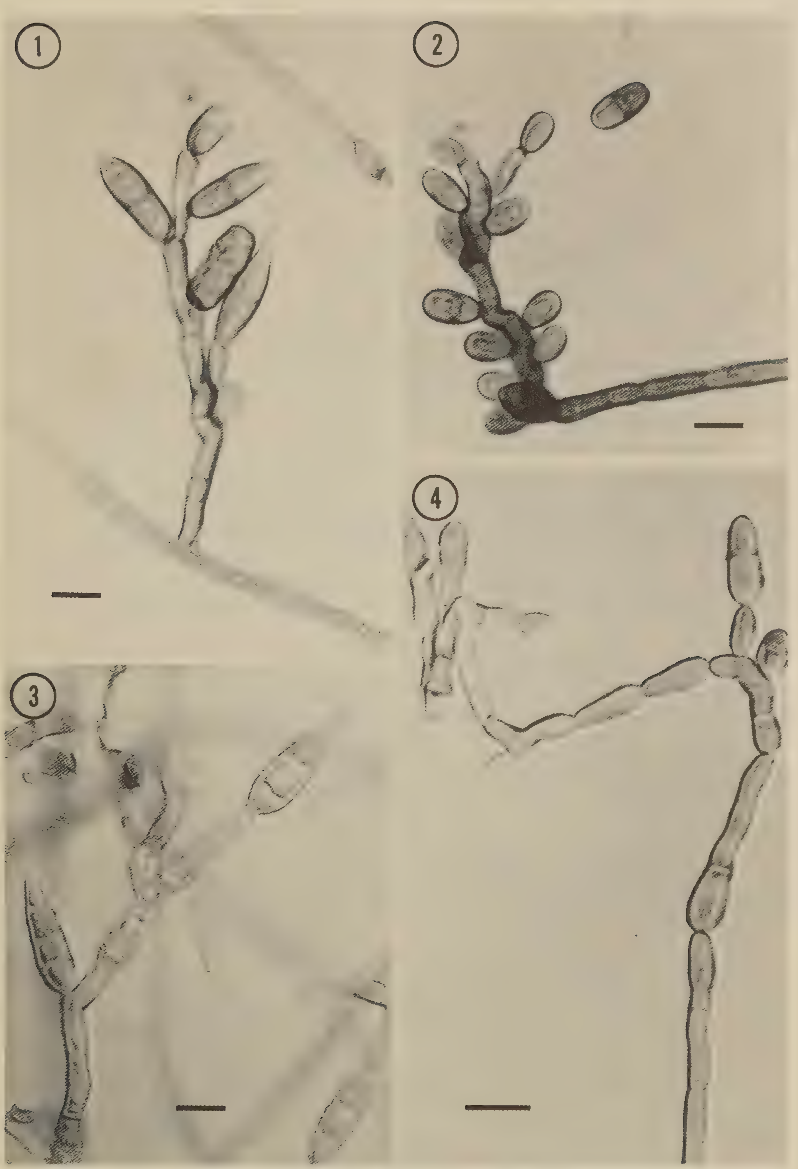
Conidiophora solitaria, recta vel parum flexuosa, septata, brunneola, laevia vel verruculosa, simplicia vel parce ramosa; augmen in longitudinem ramulorum determinatum vel subapicaliter prolificum. Conidia blastica, solitaria vel acropete torulose catenata, partim disjuncta per intervallum periphericum in pariete extimo, tum affixa per parietem intimum aut omnino secedentia, ellipsoidea vel ovoidea, 0-1+ transeptata, initio distoseptata, demum ex parte euseptata. Typus:

Dissitimurus exedrus Simmons, McGinnis & Rinaldi, sp. nov.
Etym.: *exedrus* (away from home, strange, extraordinary).

Conidiophora solitaria, erectiuscula, castanea, laevia vel verruculosa. 4-6µm diam., 600-900-1800µm lg., plerumque 1-5 ramosa, 1-2 ramis inferioribus 50-60µm lg., ramis superioribus vulgo 200+µm lg. Conidia ellipsoidea vel ovoidea, interdum anguste ovoidea vel cuneata, laevia vel verruculosa, dilute brunnea, initio 0-4 (plerumque 1-3) distoseptata, demum 1-2 euseptata, 7-33 x 5-10µm, basi distincte complanata et apice vix perceptibile plano, acropete catenata in 10+ monadibus conidioideis tenacibus vel secedentibus. Habitatio typi in laesionibus nasopharyngialibus hominis feminei. Typus: partes ex EGS 38: 161 (reisol. ex cult. lect. in Providence Medical Center, Portland, Oregon, USA) desiccatae et in BPI (holotypus) et pro isotypis saltem in NCU, IMI et NY conservandae.

DISSITIMURUS Simmons, McGinnis & Rinaldi, gen. nov. Primary conidiophores arise directly from vegetative hyphae at or below the substrate surface and are solitary, suberect, straight to somewhat flexuous, septate, brown, smooth to verruculose, sparingly branched; each branch terminates in a single apical conidiogenous site but may proliferate by means of a secondary conidiophore that arises just below the initial conidiogenous site. Conidium initiation is blastic, probably initially holoblastic but with the outermost wall layer breaking circumferentially and becoming disjunct, after which chain connection is entirely a function of the exposed inner wall. Conidia are ellipsoid to ovoid, 0-1+ transeptate, with walls and septa relatively thick and appearing distoseptate except when thin transverse eusepta develop tardily, smooth to slightly rough; initial conidia may remain solitary, or may give rise to acropetal chains of conidia, or may generate short to very long secondary, often multi-geniculate conidiophores, which in turn produce solitary or catenate conidia.

Dissitimurus exedrus Simmons, McGinnis & Rinaldi, sp. nov. Conidiophores solitary, produced consecutively in abundance as suberect outgrowths from spreading, intertwined surface and subsurface vegetative hyphae; chestnut brown, smooth to verruculose, septate, commonly with 1-5 branches, of uniform structure throughout until growth stops when terminal sporulation begins; primary conidiophore 4-6µm d., lengthening to 600-900-1800µm over a period of 2-5 da., 1-2 lower branches short (50-60µm), upper branches often 200µm or more in length. Conidia develop blastically from conidiophore apices, the somewhat constricted area of contact at maturity having a diameter about 0.1 to 1.0 of the total conidiophore width. Conidia



Figs. 1-4. Dissitimurus exedrus, conidiophores (sometimes conspicuously ornamented), conidiophore branches, conidia and conidioid chains; horizontal bar = 10μm.

are ellipsoid to ovoid, sometimes narrowly ovoid with apical taper, smooth to verruculose, dilute brown with paler end(s), 0-4 (mostly 1-3) distoseptate with tardy insertion of 1-2 eusepta, 7-33 x 5-10 (av. 19.7 x 6.1)μm, with distinctly flattened base and occasionally barely perceptibly flattened apex, and with the outer wall layer terminating in a ring through which an inner paler portion of the conidium expands. Conidia may produce morphologically distinct, apical conidiophores that often are short (1-2 geniculations, 7-8μm long) but that very often develop into sporulation complexes up to 500-600μm long with multiple conidiogenous geniculations. Most frequently, however, moderately long, sometimes branching chains of readily disjunct conidia and of morphologically similar but tenacious conidioid units are produced in acropetalous succession (10+ units).

The outer wall layer of conidia and of non-deciduous conidioid cells usually does not completely cover the inner wall, which is continuous throughout the developing chain. The apical and basal limits of the conidium outer wall appear as rings through which the slightly paler, somewhat constricted and septate chain connective extends.

Type: dried portions of cultures from EGS 38: 161 (from an isolate from human nasopharynx and turbinate lesions in a female patient, Providence Medical Center, Portland, Oregon, USA), conserved in BPI (holotype) and with isotypes also at least in NCU, IMI and NY. Subcultures of this isolate are being deposited in international culture collections.

Dissitimurus exedrus is known to us thus far only on the basis of a single clinical isolate. Cultures of the fungus (PCA and Hay plates, 20-25C, cycled cool-white fluorescent light, 8/16 hrs light/dark) have a growth rate of about 1 cm/wk; most of the black-brown colony is subsurface, the aerial portion being composed entirely of a stand of distinct, very long conidiophores. (Colonies on 20% V-8 juice agar are so dense aerially that progressive patterns of conidiophore and conidium production are obscured.) Sporulation is absent or very sparse for about the first week, i. e., until the conidiophores have reached considerable height (several 100μm) and have started to branch; truly abundant sporulation is found only after 2-3 weeks of colony development. As colonies age beyond 2-3 weeks, sporulation begins to occur on shorter conidiophores that may develop as an understory in the colony.

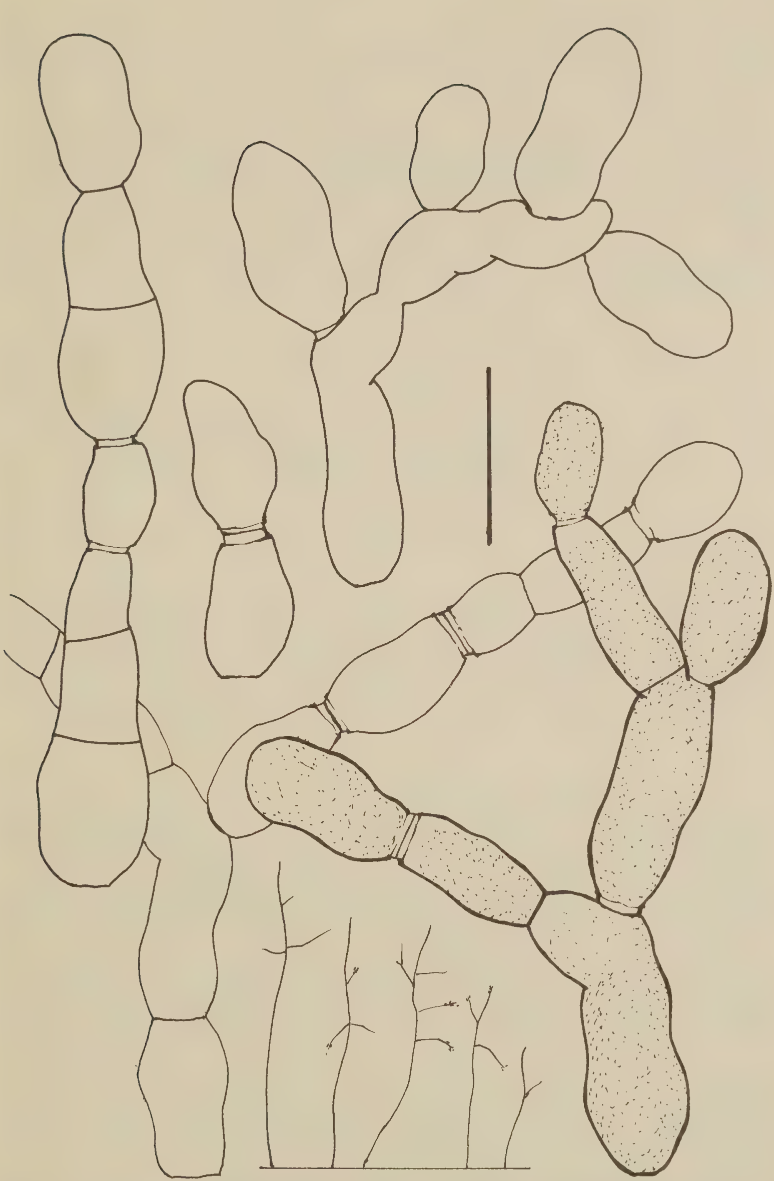


Fig. 5. Dissitimurus exedrus, conidia, primary and secondary conidiophores; vertical bar = 10µm. Branching conidiophores (habit sketch, lower center) max. ht. = ca. 1000µm.

Diagnostic characters for the genus center on the nature of the conidiophore and on the peculiar method of conidium chain generation and disarticulation. Typically, conversion of conidiophore apices (main axis and branches) from an elongation to a sporulation mode occurs only after the main axis has reached extraordinary length; even scarification of surface growth (which would induce sporulation overnight in cultures of many dematiaceous hyphomycetes, such as most *Alternaria* species) simply clears the way for production of new conidiophores, which go through several days of elongation before producing conidia.

Primary conidium initiation may be truly holoblastic, with all wall layers of the conidiophore continuous with those of the young conidium (the precise relationship is difficult to assess with light-microscope techniques.) Acropetalous proliferation of conidia and conidioid units in monilioid and eventually superficially alternarioid chains also may be holoblastic. However, the continuity of the outermost wall layer almost always is broken near the constricted region between adjoining conidia. Continuity of the chain through this constricted zone is by means of the slightly protruding, exposed apex and base of the contiguous cells. A transverse septum usually forms in the narrowest part of the broad connective. Conidia and series of conidioid cells break free at this septum; the conidium base appears flat in the region of this disrupted septum.

Prolonged efforts to interpret this fungus as a curious and puzzling *Alternaria* finally have been abandoned. It is true that the sporulation pattern of aging cultures appears alternarioid, with branching chains of septate, ovoid units. It also is true that distoseptation followed by insertion of eusepta in conidia often occurs in typical *Alternaria*. However, the unique *Dissitimurus* feature of a relatively robust, secondarily exposed, chain-generating connective that releases sporulation units by breaking at a well-defined transeptum is foreign to every current concept of the genus *Alternaria* and should remain so. Other dematiaceous genera, considered in passing by us and by obliging colleagues at the C.A.B. International Mycological Institute, Kew (M. B. Ellis, S. M. Francis, A. Sivanesan), are considered equally unserviceable.

M. E. Barr Bigelow has performed her customarily generous and prompt presubmission review of this manuscript for us. We are grateful.

MYCOTAXON

Vol. XXX, pp. 253-262 October-December 1987

TAXONOMIC CONCEPTS IN THE ENDOGONACEAE: IV. *GLOMUS FASCICULATUM* REDESCRIBED.

CHRISTOPHER WALKER

Forestry Commission, Northern Research Station, Roslin, Midlothian, EH25 9SY, UK

and

R. E. KOSKE

Department of Botany, University of Rhode Island, Kingston, Rhode Island 02881, USA

SUMMARY

The history of and difficulties in identifying the fungus *Glomus fasciculatum* are discussed, the species is redescribed with a standardized terminology, and the formal description emended. Spores are pale yellow to pale yellow-brown, (50-)60-95(-149)x55-90(-149) μm, with a spore wall structure of an outer, hyaline, unit wall, 0.2-1.0(-1.8) μm thick: a pigmented, laminated middle wall (2.0-)5-10(-14.3) μm thick; and a hyaline, membranous, innermost wall 0.1-0.9 μm thick that stains red-brown in Melzer's reagent. The subtending hypha is relatively broad, being (3.5-)9-15(-19.0) μm wide at the spore base.

INTRODUCTION

Among the described species of vesicular-arbuscular mycorrhizal fungi, *Glomus fasciculatum* (Thaxter sensu Gerd.) Gerd. & Trappe is perhaps the one most commonly reported from soil surveys, and most often cited as used in studies of plant growth responses (Walker 1985). It is, for example, listed 60 times in the index of the *Proceedings of the Sixth North American Conference on Mycorrhizae,* a figure approached only by *G. mosseae* (Nicol. & Gerd.) Gerd. & Trappe (Molina 1985).

Our examination of many isolates assigned to this taxon reveals confusion about the characteristics that should be used to distinguish it from other species in the genus. Very few of the fungi that we have examined correspond to Thaxter's original type material, and it is evident that the species frequently is misidentified (Walker 1983a, 1985, 1986).

In the original description of the species (Thaxter 1922) the spores were described as being produced in small fascicles ("sporocarps") and were "... pale yellowish or faintly brownish, mostly spherical or somewhat longer than broad, 60x60-85x70 μm ... [p. 308].". In Fig. 27 of that publication, Thaxter illustrated (at the spore base) a thin, outermost wall layer attached to a thicker, inner wall, although no mention was made of this feature in the text.

In the 1950s, *G. fasciculatum* was reported and illustrated from soil and the stomach contents of rodents in western Canada (Dowding 1955, Bakerspigel 1956). Both authors noted the presence of a thin outer wall and a thick, laminated ("striated") inner wall. Dowding (1955) referred to the inner wall as an "endospore" despite the fact that it was continuous with the walls of the attachment hypha.

Gerdemann (1965) examined type material of *G. fasciculatum* from Quebec and, noting that there were two collections included, designated the one labeled N:5 as a lectotype. At about the same time, he established a pot culture of a fungus which he considered to be *G. fasciculatum* (Gerdemann 1964). This fungus was described and illustrated in the 1965 paper as typical of the species, though no outer wall was noted. We have examined this material, and in our opinion it is *G. aggregatum* Schenck & Smith emend. Koske, a species frequently confused with *G. fasciculatum* (Koske 1985).

In their monograph of the Endogonaceae in the Pacific Northwest, Gerdemann & Trappe (1974) considerably expanded Thaxter's existing description of *G. fasciculatum*. This presently seems to be the most widely used concept of the species, apparently being incorporated in a number of recent keys (Hall & Fish 1979, Trappe 1982, Hall 1984). The spores were described as "... 35-105 μm diam when globose, 75-150x35-100 μm when subglobose to obovate, ellipsoid, sublenticular, cylindrical or irregular ... spore walls highly variable in thickness (3-17 μm) hyaline to light yellow or yellow brown ... hyphal attachments 4-15 μm, occluded at maturity. Walls of attached hyphae often thickened to 1-4 μm near the spore [p. 51]." Spores were not illustrated or figured, and no mention was made of a thin, outermost wall. This is an extremely broad description and it was recognized that "... a more intensive study of the relationships within this group is needed ... [p. 53]."

Glomus fasciculatum sensu lato has now been shown to include several distinct taxa, some of which (e.g., *G. deserticola* Trappe, Bloss & Menge, *G. aggregatum,* and *G. hoi* Berch & Trappe) have been named (Schenck & Smith 1982, Trappe, Bloss & Menge 1984, Koske 1985, Berch & Trappe 1985). Since 1974, the importance of spore wall characteristics in the taxonomy of the Endogonaceae has been increasingly recognized (Trappe & Schenck 1982, Walker 1983b, 1986), and such criteria were of major significance in segregating new species from *G. fasciculatum sensu lato.* However, the spores of *G. fasciculatum sensu stricta* have not been adequately redescribed or illustrated to show the features now considered to be important identifying characteristics.

The following redescription of *G. fasciculatum sensu stricta* is based upon examination of Thaxter's sporocarpic material from the Farlow Herbarium, another collection from the type locality, Little Metis, Quebec, made in 1983, and 11 other collections made from several different parts of the world. Despite its wide distribution, the species has spores that show a high degree of consistency in morphology, and the taxon is clearly defined and stable, indicating that the large range of morphology previously attributed to it was due to taxonomic error, rather than to phenotypic instability or variation.

Terminology for features of spore wall structure follows that of Walker (1983b). Descriptions are made from spores in mountants based on polyvinyl-alcohol, with (PVL) and without (PVLG) phenol (Walker 1979, Koske & Tessier 1983), standard mountants we generally use for all our taxonomic descriptions. Thaxter's material was preserved in an unidentified fluid, and is in very poor condition (Fig. 1).

Nonetheless, it proved possible to make microscope slide mounts in which essential features were still evident (Fig. 1). Other collections were preserved either in lactophenol, which usually changes the color of endogonaceous spores (Gerdemann 1965, Hall 1984, Koske & Walker 1985), or in 5% aqueous formaldehyde solution, which preserves color better, but which tends to render the spores brittle and may result in fusion of adjacent walls (Koske & Walker 1986). Voucher collections have been deposited in the Farlow Herbarium (FH), or the Herbarium of Oregon State University (OSC). Measurements given are from a total of 177 spores from eight different collections.

SPECIES DESCRIPTION

GLOMUS FASCICULATUM (Thaxter) Gerdemann & Trappe emend. Walker and Koske.

Figures 1-3.

Sporocarps hypogeous or epigeous, up to 1 mm diam, irregularly globose or flattened, sometimes tuberculate, pale yellow to pale yellow-brown; peridium lacking. Spores, (50-)60-95(-149)x55-90(-149) μm, formed singly in the soil, in loose aggregations, compact clusters, or sporocarps; globose, subglobose, sublenticular, or occasionally irregular; pale yellow to pale yellow-brown. Spore wall structure (see murograph, Fig. 3) of three walls (1-3) in one group (A). Wall 1 a smooth, hyaline unit wall, 0.2-1.0(-1.8) μm thick. Wall 2 pale yellow to pale yellow-brown, laminated, (2.0-)5.0-10.0(-14.3) μm thick. Wall 3 a hyaline, membranous wall, 0.1-0.9 μm thick, adherent to wall 2, staining red-brown in Melzer's reagent. Subtending hypha (6-)33-75(-260) μm long, often paler in color than the spore, flared, straight, or slightly constricted proximally, (3.5-)9.0-15.0(-19.0) μm broad at the spore base with walls 3-6(-8) μm thick proximally, tapering to 1.5-2.0 μm thick distally. Pore open, or closed by thickening of wall 2.

COLLECTIONS EXAMINED

1. LECTOTYPE: **CANADA** - Quebec Province, Matane County, Little Metis; in sphagnum moss (Collection N:5 of E. C. Jeffrey) (FH 5048). OTHER COLLECTIONS: **2. CANADA** Quebec Province, Matane County, Little Metis; in sphagnum moss (Koske 533, Walker 653); **3. USA** - California, Santa Barbara County (Koske 579); **4.** Massachusetts, Bristol County from J. Gemma (Gemma 05-48-23); **5.** Rhode Island, Washington County (Koske 475, 10A, Walker 650); **6.** Iowa, Ames, in pot culture with *Zea mays L.,* origins unknown (Walker 316); **7.** Oregon, Benton County (OSC 30456, 30967); **8.** Jefferson County (OSC 30455); **9.** Lincoln County

(OSC 30823); **10.** Nevada, Reno, in mixed pot culture with *Glomus clarum* Nicol. & Schenck from Dr. G. Bethlenfalvay (Walker 779); **11.** Washington, San Juan County (OSC 32390); **12. UK** - Scotland, Borders Region, Manor Valley, from upland pasture (Walker 290); Midlothian, Bush, from mixed grasses and forbs (Walker 780); **13. ITALY** -Torino, Botanical Gardens, in pot culture with *Allium porrum* L., from Dr. V. Gianinazzi-Pearson, INRA, Dijon, France (Walker 1161).

DISCUSSION

G. fasciculatum sensu stricta is distinguished from other species by its spores which are pale yellow to pale yellow-brown in color with a somewhat broad, thick-walled subtending hypha, and which have a spore wall structure of three walls in a single group. The thin, outermost wall is visible in most specimens (Fig. 2) and is persistent, though it may be very thin and difficult to see even at high magnifications. The laminated wall 2 typically is 5-10 μm thick, but may be much thinner (±2 μm), and occasionally may be almost 15 μm in thickness. Wall 3 is difficult to observe in fresh, unstained spores, although it is revealed by its reaction to Melzer's reagent, application of which causes it to become dark red-brown. After a few hours in this reagent, the reaction begins to spread into wall 2. Wall 3 does not form a complete endospore, but apparently is continuous with the subtending hypha.

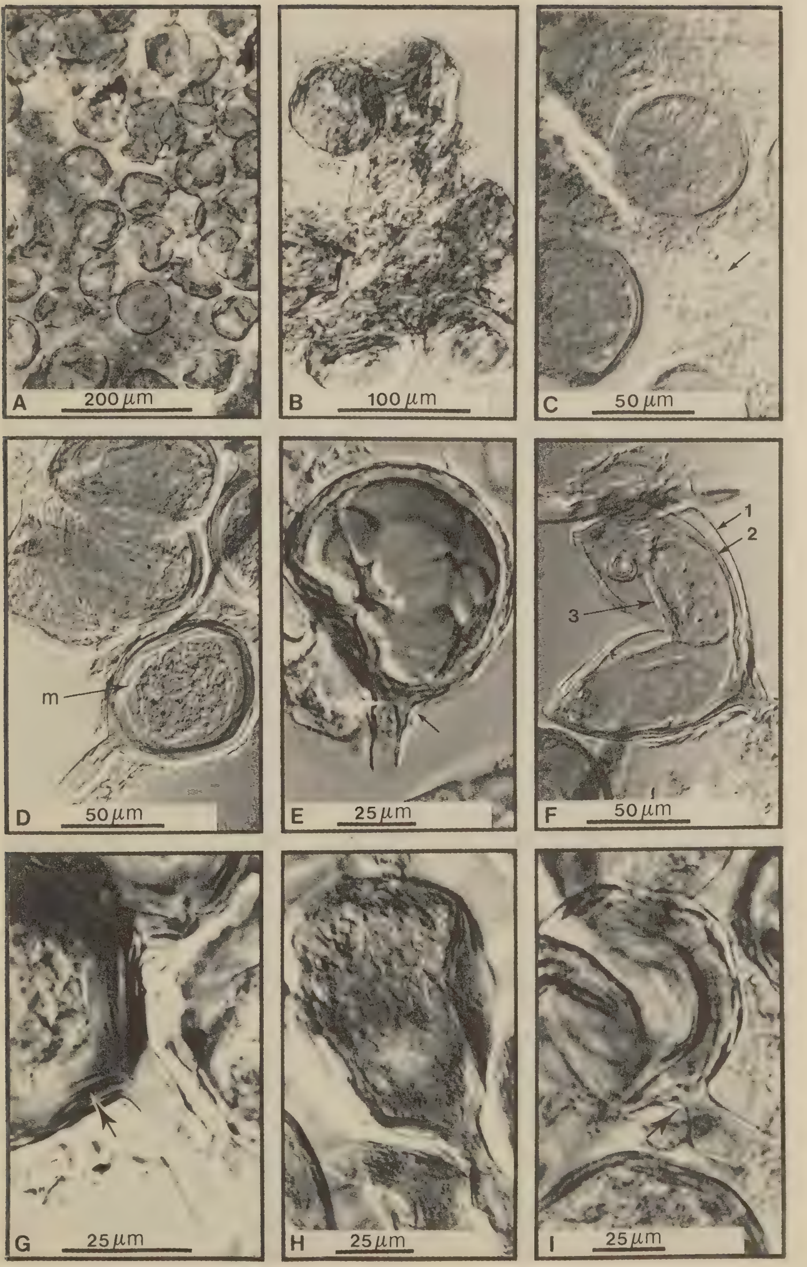
When spores were left in soil in a plastic bag for 2 years at 5°C, wall 3 became easily visible, even in unstained spores, because it separated from wall 2 and collapsed when mounted in PVL or PVLG. The appearance of these spores was almost identical to some of the specimens in Thaxter's type material, although in much of the type, wall 3 is difficult to discern.

The color of spores of *G. fasciculatum* varies from pale yellow to very pale yellow-brown. We have never observed either brown or red-brown spores of this species, except when preserved in lactophenol or FAA (both substances cause the walls to

---

Fig 1: *Glomus fasciculatum.* Chlamydospores from the original type material used by Thaxter (1922) in his protologue description. Most of the type material is in a very poor state of preservation.

A) Sporocarpic spores densely embedded in a hyphal matrix.
B) Fascicle of spores.
C) Individual spores dissected from a sporocarp. Note subtending hypha (arrow).
D) Spore with inner, membranous wall (m) indicated.
E) Spore with subtending hypha closed by spore wall thickening (large white arrow). Wall 1 is particularly evident where it has broken away slightly from wall 2 near the spore base (small black arrow).
F) Unit wall (1) separated from laminated wall (2) in a crushed spore. Membranous wall (3) is visible because of its wrinkling.
G) Lamination in wall 2 (large arrow). Note open lumen in the subtending hypha (see also Fig. 2C).
H) Spore showing wrinkling of wall 3 as a result of poor preservation.
I) The subtending hypha of this specimen is (unusually) constricted at the spore base (arrow).


A
200 µm
B
100 µm
C
50 µm
D
m
50 µm
E
25 µm
F
1
2
3
50 µm
G
25 µm
H
25 µm
I
25 µm

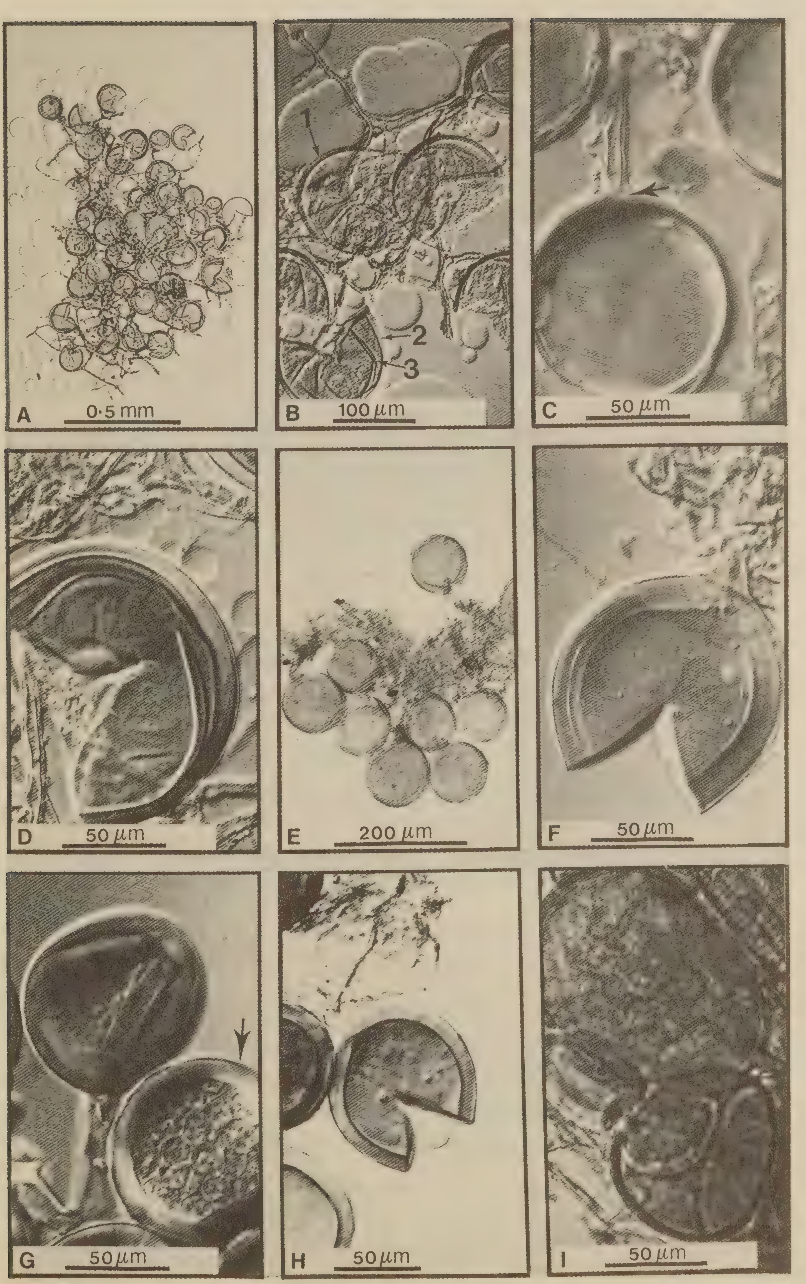
darken considerably). Neither have we seen hyaline or white spores of *G. fasciculatum.* In all the living cultures we have examined, even the youngest spores are pale yellow.

The subtending (attachment) hypha of *G. fasciculatum* spores usually is persistent, straight, with relatively little taper, and slightly paler in color than the spore itself. The pore of the hypha may be open, or may be closed by thickening of wall 2 (Fig. 2C, 2F), but it is never closed by a septum.

We have recovered *G. fasciculatum* from soil as single spores, as spores in compact clusters, and as small sporocarps (lacking a peridium) which are between 250 μm and 1 mm across. Such sporocarps lack a structured peridium, and may incorporate fragments of the substrate such as sand grains. The color of the sporocarps we have examined varies from pale yellow to pale yellow-brown, in contrast to that reported by Gerdemann (1965) which was "light cream". Sporocarp dimensions listed in the redescription of Gerdemann & Trappe (1974) were up to 8x5x5 mm, although, because of the broad interpretation of the species in that publication, it is impossible to be sure of the identity of the specimens used to obtain these measurements. Since Thaxter's (1922) descriptions of sporocarps were made from a mixed collection containing *Endogone* and *Tuber* spp. as well as *G. fasciculatum* chlamydospores (Gerdemann 1965), it is impossible to be sure how large the sporocarps in the collection were. It is our opinion that, for this species, sporocarp dimensions are not reliable taxonomic characteristics. It is sufficient to know that spores of this fungus can be found either singly, in loose clusters, or in dense aggregations that can be described as sporocarps.

Fig. 2: *Glomus fasciculatum.* Recent collections, numbered as in 'Collections Examined' in text.

A) A loose cluster of spores from collection 13. The contents of the crushed spores appear as globules in the mounting medium.
B) Detail of a portion of the cluster in A. The three walls are indicated (1, 2 & 3).
C) Intact spore from the cluster in A. The lumen of the subtending hypha has been constricted by ingrowth of the walls (arrowed).
D) Crushed spore from collection 13 showing all three walls. The collapse of wall 3 reveals its membranous nature.
E) Fascicle of spores recovered from collection 2.
F) Spore from collection 2. All three walls are visible. Note the partial closure of the lumen of the subtending hypha by spore wall thickening.
G) Spores from collection 5. The spore in the lower right of the photograph is parasitized. The membranous inner wall (wall 3) is wrinkled. The outer wall (wall 1) is arrowed. Note unusually thick laminated wall 2.
H) Crushed spore from collection 5. Wall 3 has not separated in this specimen, but has stained darkly in Melzer's reagent.
I) Spores in roots from collection 10.


1
2
3
A
0·5 mm
B
100 μm
C
50 μm
D
50 μm
E
200 μm
F
50 μm
G
50 μm
H
50 μm
I
50 μm

In our experience, *G. fasciculatum* is not common. It is likely that many isolates of other fungi have been erroneously identified as *G. fasciculatum* and used in published studies. Because of this, the interpretation of the literature is difficult, if not impossible. Few voucher specimens have been lodged, and it often is impossible therefore to verify identification. In a sample of 10 collections from those examined by Gerdemann & Trappe for their redescription, only five (Trappe numbers 30455, 30456, 30823 (part), 30967 and 32390) coincided with our concept of *G. fasciculatum.* The remaining specimens were either undescribed, or were species (*G. aggregatum, G. hoi* or *G. intraradices*) that have been described since 1974. Other species we have examined that have been commonly misidentified as *G. fasciculatum* include G. deserticola, G. invermaium Hall, *G. feugianum* (Spegazzini) Trappe and Gerd., *G. occultum* Walker, *Sclerocystis rubiformis* Gerd. & Trappe, and several other undescribed species. The Rothamsted isolate often known as E3 and frequently cited as *G. fasciculatum* is definitely not that species, and is undescribed.

At present, because they are poorly known, it is impossible to decribe all of the species that have been confused with *G. fasciculatum* or to differentiate them from each other and from *G. fasciculatum sensu stricta.* Our intent has been to establish a new, clarified description of the species from which further studies can be made as appropriate. *Glomus fasciculatum* is clearly defined by the characteristics described and discussed here, which may be summarized as follows:

Glomus fasciculatum

HAS

*BOTH ECTOCARPIC AND SPOROCARPIC SPORES
*SPORES 50-149x55-149 μm IN SIZE
*SPORES WHICH MAY BE QUITE VARIABLE IN SHAPE, BUT WHICH USUALLY ARE GLOBOSE TO SUBGLOBOSE
*SPORES WITH A WALL STRUCTURE OF:
  - a thin, hyaline outer unit wall
  - a thicker, yellow to pale yellow-brown middle laminated wall
  - a thin, hyaline, inner, membranous wall [the muronym (Walker 1986) is A(ULM)]
*A REACTION TO MELZER'S REAGENT. THE INNER WALL TURNS RED

DOES NOT HAVE

*BROWN OR RED CHLAMYDOSPORES
*HYALINE CHLAMYDOSPORES
*ONE- OR TWO-WALLED SPORES
*SPORES WITH CONTENTS OCCLUDED BY A SEPTUM
*SPORES LESS THAN 50 μm DIAMETER

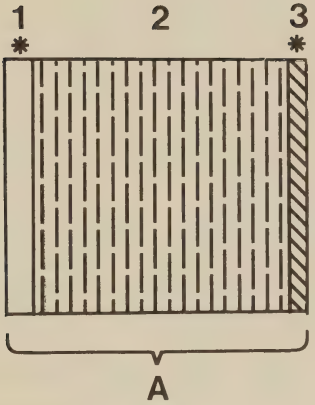


Fig. 3: Murograph (after Walker 1983) of *Glomus fasciculatum* sensu Walker & Koske. Wall 1 is a unit wall, wall 2 is a laminated wall, and wall 3 is a membranous wall. Asterisks indicate that the walls may be difficult to see. The muronym (Walker 1985) is A(ULM)

ACKNOWLEDGMENTS

We thank J. Gemma, V. Gianinazzi-Pearson, and G. Bethlenfalvay for providing specimens of *G. fasciculatum,* W. L. Halvorson for making possible the collecting trip to California and T. H. Nicolson for kindly reviewing the manuscript. We also thank the keepers of the Farlow Herbarium and the Herbarium of Oregon State University for loan of specimens, and D. Matthews for preparing the plates.

LITERATURE CITED

Bakerspigel, A. 1956. *Endogone* in Saskatchewan and Manitoba. *American Journal of Botany* **43**:471-475.

Berch, S. M. and Trappe, J. M. 1985. A new species of Endogonaceae, *Glomus hoi. Mycologia* **77**:654-657.

Dowding, E. S. 1955. *Endogone* in Canadian rodents. *Mycologia* **47**:51-57.

Gerdemann, J. W. 1964. The effect of mycorrhiza on the growth of maize. *Mycologia* **56**:342-349.

Gerdemann, J. W. 1965. Vesicular-arbuscular mycorrhizae formed on maize and tuliptree by *Endogone fasciculata. Mycologia* **57**:562-575.

Gerdemann, J. W. and Trappe, J. M. 1974. The Endogonaceae in the Pacific Northwest. *Mycologia Memoir* No. 5. 76pp.

Hall, I. R. 1984. Taxonomy of VA mycorrhizal fungi, pp. 57-94 in VA *Mycorrhiza,* ed. by C. Ll. Powell & D. J. Bagyaraj. CRC Press, Florida.

Hall, I. R. and Fish, J. 1979. A key to the Endogonaceae. *Transactions of the British Mycological Society* **73**:261-270.

Koske, R. E. 1985. *Glomus aggregatum* emended: a distinct taxon in the *Glomus fasciculatum* complex. *Mycologia* **77**:619-630.

Koske, R. E. and Tessier, B. 1983. A convenient, permanent slide mounting medium. *Mycological Society of America Newsletter* **34(2)**:59.

Koske, R. E. and Walker, C. 1985. Species of *Gigaspora* (Endogonaceae) with roughened outer walls. *Mycologia* **77**:702-720.

Koske, R. E. and Walker, C. 1986. Species of *Scutellospora* (Endogonaceae) with smooth-walled spores from maritime sand dunes: two new species and a redescription of the spores of *Scutellospora pellucida* and *Scutellospora calospora. Mycotaxon* **27**:183-194.

Molina, R. (ed.). 1985. *Proceedings of the 6th North American Conference on Mycorrhizae.* Forest Research Laboratory, Corvallis, Oregon, 471 pp.

Schenck, N. C. and Smith, G. S. (1982). Additional new and unreported species of mycorrhizal fungi (Endogonaceae) from Florida. *Mycologia* **74**:77-92.

Thaxter, R. 1922. A revision of the Endogonaceae. *Proceedings of the American Academy of Arts and Sciences* **57**:291-351.

Trappe, J. M. 1982. Synoptic keys to the genera and species of Zygomycetous mycorrhizal fungi. *Phytopathology* **72**:1102-1108.

Trappe, J. M. and Schenck, N. C. 1982. Taxonomy of the fungi forming endomycorrhizae. A. vesicular-arbuscular mycorrhizal fungi (Endogonales). pp. 1-9. in N. C. Schenck, ed., *Methods and Principles of Mycorrhizal Research.* The American Phytopathological Society, St. Paul, Minnesota.

Trappe, J. M., Bloss, H. E. and Menge, J. A. 1984. *Glomus deserticola* sp. nov. *Mycotaxon* **20**:123-127.

Walker, C. 1979. The Mycorrhizast and the herbarium: the preservation of specimens from VA mycorrhizal studies. p. 96 in *Program and Abstracts, 4th N. American Conference on Mycorrhiza.* Fort Collins, Colorado.

Walker, C. 1983a. *Glomus fasciculatum* a taxon misunderstood, pp. 18-19 in *Current Mycorrhizal Research,* ed. by J. Dighton. Merlewood Research and Development Paper No. 95, Institute of Terrestrial Ecology, Grange-over-Sands, Cumbria.

Walker, C. 1983b. Taxonomic concepts in the Endogonaceae: spore wall characteristics in species descriptions. *Mycotaxon* **18**:443-455.

Walker, C. 1985. Taxonomy of the Endogonaceae, pp. 193-199 in *Proceedings of the 6th North American Conference on Mycorrhizae,* ed. by R Molina. Forestry Sciences Laboratory, Corvallis, Oregon.

Walker, C. 1986. Problems in the taxonomy of mycorrhizal fungi, pp. 605-609 in *Physiological and Genetical Aspects of Mycorrhizae,* ed. by V. Gianinazzi-Pearson & S. Gianinazzi. INRA, Paris.

MYCOTAXON

Vol. XXX, pp. 263-267 October-December 1987

NEW HYPHOMYCETES FROM SANTIAGO RIVER. II.(BUENOS AIRES PROVINCE, ARGENTINA)

ANGELICA ARAMBARRI, MARTA CABELLO AND ADRIANA MENGASCINI

Instituto "Spegazzini",53 Nº 477,1900,La Plata, Argentina.

SUMMARY

Furthering our research on Hyphomycetes from Santiago River (Argentina) four new species namely: Cheiromyces wrightii, Dactylaria isthmospora, Subulispora argentina and Tetraploa abortiva are herein described from observations on natural media.

Exsiccata are available at the Spegazzini Institute (LPS).

Cheiromyces wrightii Mengascini, Cabello et Arambarri sp. nov. Fig.1
Fructificatio sporodochia. Sporodochia dispersa, punctiformia, atra. Conidiophora dense agregata, hyphis vegetativis vix distinguibilia, brunnea vel modice brunnea. Cellulae conidiogenae integratae, terminal, pallide brunnea. Conidia cheiroidea, 18-26 um longa, 12-21 um lata, pallide fusca ex 3-5 ramis composita, rami 13-22 um longi, 4-5 um crassi, 3-5 septati ad septa leviter constricti.
Holotypus: Argentina, Buenos Aires, río Santiago, leg. Mengascini & Steciow,IV/1987, ex cortice putrida, in Herb. LPS 44305 conservatus est.

Etymology: In honour of prof. Jorge E. Wright.

Sporodochia scattered, punctiform, black. Conidiophores caespitose, micronematous or semimacronematous, brown or pale brown. Conidiogenous cells holoblastic, integrated, terminal, light brown. Conidia digitiform, 18-26 um long, 12-21 um wide, light brown, with 3-5 branches; each branch 13-22 um long, 4-5 um thick, 3-5 septate, constricted at the septa.

Our species differs from C. stellatus Berkeley et Curtis by the larger size of the conidia, from C. bulbophorus Matsushima and C. inflatus Matsushima by the shape of the conidia (Matsushima, 1983).

Dactylaria isthmospora Cabello, Mengascini et Arambarri sp. nov. Fig.2-3.
Coloniae in foliis ramisque putridis expansae, albidae. Mycelium superficiale ex hyphis septatis, 1-3 um crassis

compositum. Conidiophora solitaria, recta vel leviter flexuosa, septata, sub-hyalina, tenui tunicata, demum in parte basilari brunneola, apicem pallidiora laevia usque ad 100 um longa, 4-6 um crassa. Cellulae conidiogenae integratae, holoblasticae, hyalina, 3-5 denticulos conidiiferos hebetes ad 1.2 um longus ferentia. Conidia hyalina, lineari-obtriangularia, 30-40 um longa, latissima, 1.5-2.6 um in parte media, ad utrinque ad 1 um angustata, 3 septatis, ad apicem globosum isthmum connecta.
Holotypus: Argentina, Buenos Aires, río Santiago,leg. Mengascini & Steciow,III/1987,in foliis ramiisque emortuis, in Herb. LPS 44307 conservatus est.

Etymology:From Latin isthmum=isthmum and spora=spore referring to the globose apex of the spore connected by an isthmum.

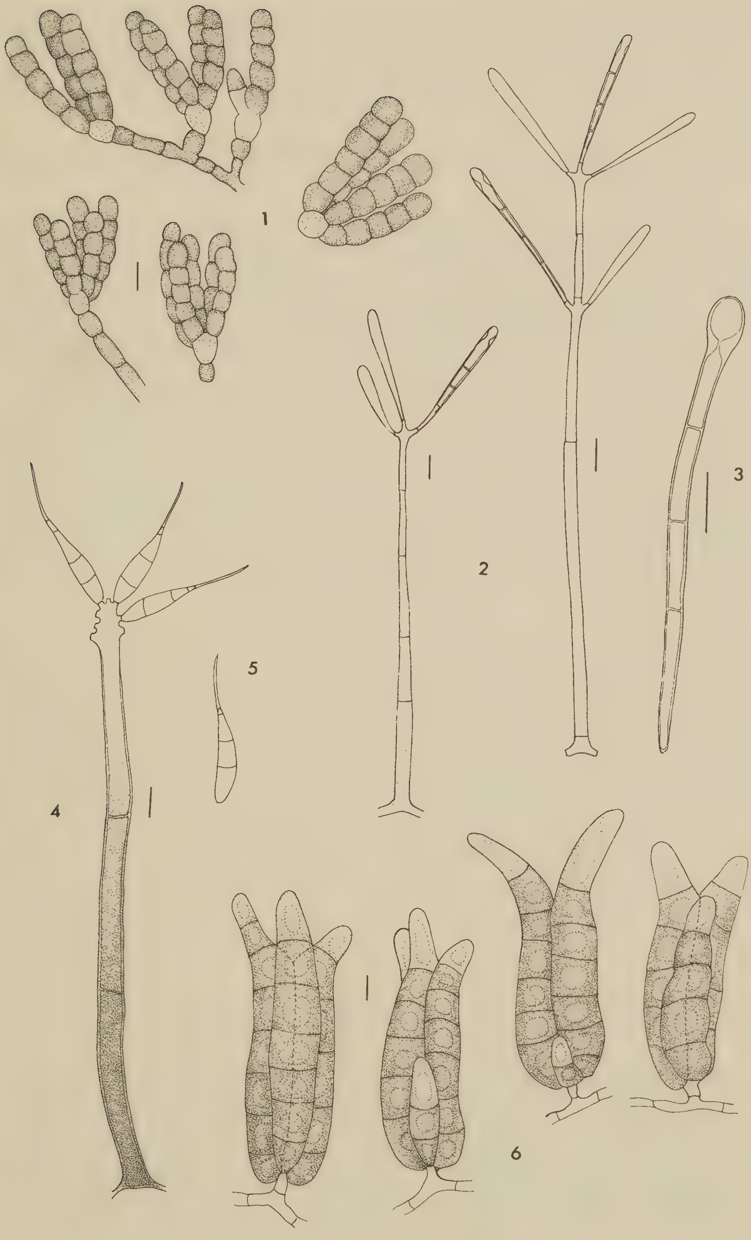
Colonies on rotten leaves and bark expanding, whitish. Mycelium superficial composed of septate, 1-3 um thick hyphae. Conidiophores solitary, straight or slightly flexuous, septate, hyaline, thin-walled, eventually brownish at the base, paler towards the apex, smooth, up to 100 um long, 4-6 um thick. Conidiogenous cells integrated, holoblastic, hyaline, provided with 3-5 blunt conidium-bearing denticles up to 1.2 um in length.Conidia hyaline, obtriangularis, 30-40 um long, 1.5-2.6 um thick near the middle, and 1 um in the apex, 3-septate with the globose apex connected by an isthmum.

Our species may be included in Dactylaria section Mirandina (Arn. et Mats.) de Hoog 1985 by the shape of the conidia, but differs from all the species of this section by the size of the conidiophores that in our species are longer and can proliferate to produce another conidiogenous cell, and for the special cell of the conidial tip.

Subulispora argentina Arambarri et Mengascini sp. nov. Fig.4-5.
Mycelium superficiale, ex hyphis ramosis, septatis, brunneis, laevibus, 2-2.5 um crassis compositum. Conidiophora 110-200 um longa x 3-6 um crassa, macronemata, mononemata, recta, cylindrica, 1-5 septata, laevia, pallide brunnea, parietibus crassis apicem versus pallidioribus. Cellulae conidiogenae integratae, terminales, polyblasticae, sympodiales, pallide brunneae vel subhyaline, parietibus tenuibus, cum 1-10 cicatricibus non incrassatis complanatis prominentibus 2-2.5 um diam. Conidia solitaria, sicca, simplicia, 3-septata, hyalina, obclavata, parietibus tenuibus

---

CHEIROMYCES WRIGHTII. 1. Conidiophore and conidia.
DACTYLARIA ISTHMOSPORA 2. Conidiophore and conidia; 3. Conidium.
SUBULISPORA ARGENTINA. 4. Conidiophore and conidia; 5. Conidium.
TETRAPLOA ABORTIVA. 6. Conidiophores and conidia.
Bar indicates 5 um.



25-35 um longa x 4-5 um crassa ad cicatrice basali truncata leniter incrassata, apicem versus atenuata.
Holotypus: Argentina, Buenos Aires, río Santiago, leg. Mengascini & Steciow, III/1987, in Herb. LPS 44306 conservatus est.

Etymology: From argentina referring to Argentina, the country of origin.

Mycelium superficial, composed of branched, septate, brown hyphae, 2-2.5 um wide. Conidiophores 110-200 um long x 3-6 um wide, macronematous, mononematous, straight, cylindrical, 1-5 septate, smooth, thick-walled and pale brown, becoming thinner and paler towards the apex. Conidiogenous cells integrated, terminal, polyblastic, sympodial, pale brown to subhyaline, thin-walled, with 1-10 prominent flat unthickened scars, 2-2.5 um diam. Conidia solitary, dry, simple, 3-septate, hyaline, obclavate, thin--walled with a slightly thickened basal scar, attenuated towards the apex.

The apical appendage on the conidia of S. argentina distinguish it from others species of Subulispora. In S. procurvata Tubaki, the type species of the genus, and S. rectilineata Tubaki, the apical cell of the conidium is extended distally into a filiform appendage as in our species but the latter differs in the shape and size of the conidia (Tubaki and Yokoyama, 1971).

Tetraploa abortiva Arambarri et Cabello sp. nov. Fig.6.
In substrato naturali coloniae punctiformis, tenues, aterae, planae (non cumulatae). Conidiophora micronematica, in tage tenui basali myceliali formata, flexuosa, irregulariter ramosa levia, pallide brunnea. Cellulae conidiogenae integratae, terminales, monoblasticae. Conidia oblonga vel ovoboidea, modice brunnea, plerumque ex 3-seriebus cellularibus (interdum 2-seriebus, raro 1-serie) constantia; 25-40 um x 13-15 um; unaquaeque series 6 cellulis, 5-6 um; cellulis infermis crassi-tunicatis, atrobrunneis, parte superna pallide brunnea tenui-tunicata, apice in appendicum hyalinum transmutata, 10-12 um longae, prope basim 5 um crassae.
Holotypus: Argentina, Buenos Aires, río Santiago, leg. Mengascini & Steciow,II/1987, in Herb. LPS 44308 conservatus est.

Etymology: From Latin abortivus=abortive referring to the failed growth of the columns of cells.

Colonies on natural substrate scattered, punctiform. Mycelium superficial. Conidiophores micronematous, branched and anastomosing to form a network, pale yellowish brown. Conidiogenous cells integrated, terminal, monoblastic. Conidia oblong to ovoboid, brown, 25-40 um x 13-15 um, with 2-3 columns with six cells each, 5 um diam; basal cells thick-walled dark brown; the apical cells are thin-walled and hyaline forming a short septate appendage, 10-12 um long.

Usually the conidia have three columns of cells and the fourth stops growing near the base of the conidium,has only one or two cells and when the conidia have two columns the third has failed to grow near the base.

ACKNOWLEDGEMENTS

We thank Dr. Jorge E. Wright for his critical review of the manuscript.

REFERENCES

HOOG, G. S. de. 1985. Taxonomy of the *Dactylaria* complex, IV-VI. Stud. Mycol. 26: 1-22.
MATSUSHIMA, T. 1983. Matsushima Mycological Memoirs 3: 1-90.
TUBAKI, K. & T. YOKOYAMA. 1971. Notes on the Japanese *Hyphomycetes*, V. Trans. Mycol. Soc. Japan 12: 18-26.

MYCOTAXON

Vol. XXX, pp. 269-288 October-December 1987

FUNGI OF THE APPALACHIAN MOUNTAINS

OSWALD HILBER[1], RUZENA HILBER[1],
and ORSON K. MILLER, JR.

Department of Biology, VPI&SU,
Blacksburg, VA 24061

Four pyrenomycete taxa belonging to the Lasiosphaeriaceae from the Appalachian Mountains are described and illustrated, three of which are new species: Cercophora appalachianensis O. Hilber & R. Hilber, sp. nov., Lasiosphaeria chrysentera Carroll & Munk, L. foliicola O. Hilber & R. Hilber, sp. nov., and L. munkii R. Hilber & O. Hilber, sp. nov.

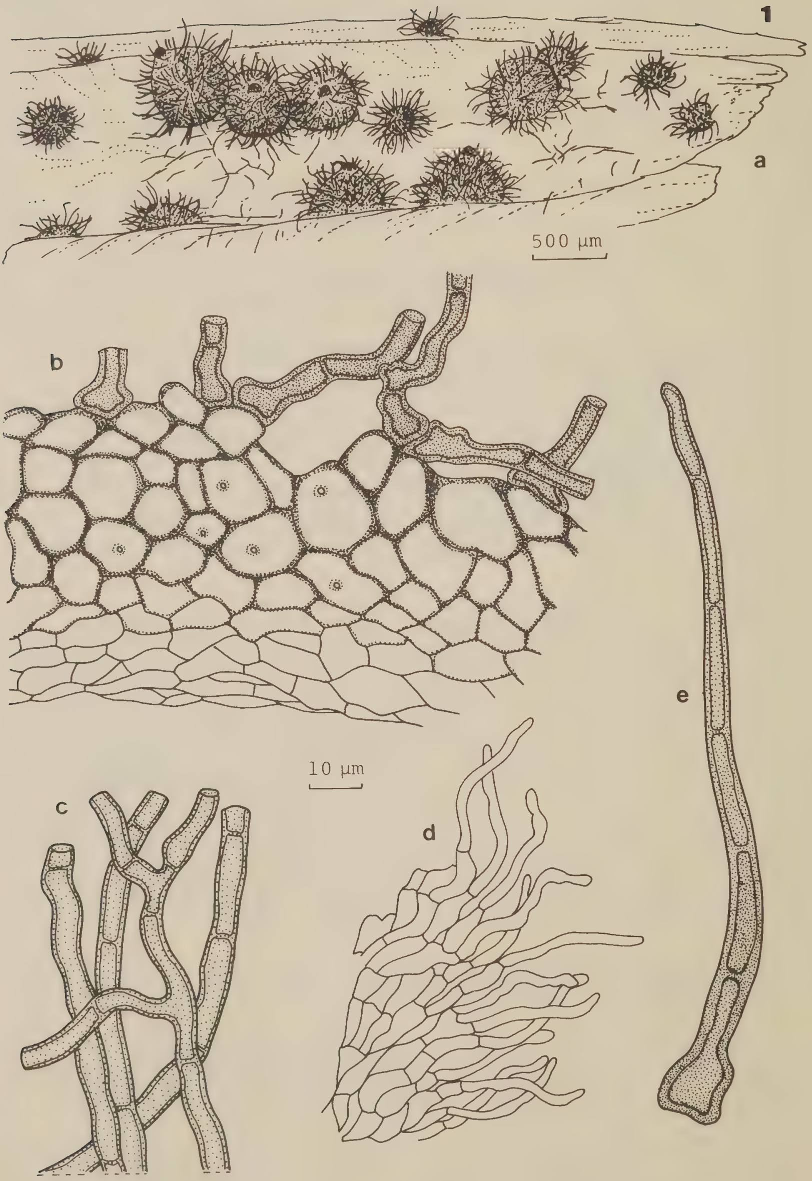
The Appalachian Mountains in the eastern United States have a large and diverse assemblage of fungal species including agarics as well as pyrenomycetes. This is due to the variety of deciduous trees, conifers and herbaceous plants combined with a moist, warm temperate climate. We were able to find several interesting taxa from the fall of 1985 until the autumn of 1986, although this period had been unusually dry. This first report deals with four species belonging to the family of the Lasiosphaeriaceae Nannf. emend Lundq. (Lundqvist, 1972).

Cercophora appalachianensis O. Hilber & R. Hilber, sp. nov.. Figs. 1-2

Perithecia 520-625 X 390-470 µm, superficialia, solitaria vel gregaria, ovata, atra, setis longis, patulis, atris, sericeo-lucidis

---

[1] Present address: Lutherstrasse 20, D-8409 Tegernheim, West Germany.


1
a
500 µm
b
10 µm
c
d
e

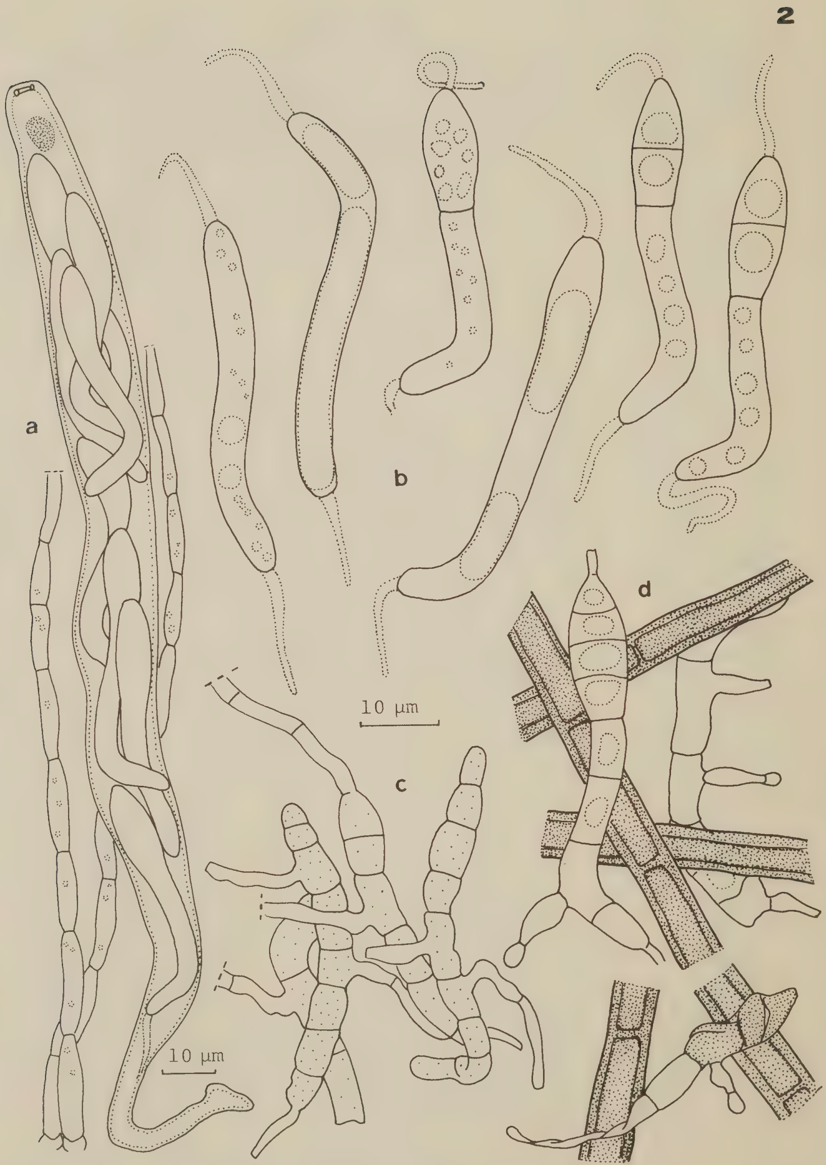
dense vestita; ostiolo 135-145 X 145-150 µm, conico, nigro, glabro vel granuloso; contento diaphano canoque. Peridium 60-80 µm, brunneum, leviter gibbosum, bistratum. Stratum externum 40-60 µm, textura angularis cellulis 10-25 X 7-18 µm, parietibus incrassatis, Munk poris dispersis. Stratum secundum 20-25 µm, brunneolum, textura prismatica cellulis 7-18 X 4.5-7 µm, tenui tunicatis. Peridium ostioli extrorsus cellulis parvis (4.5-9 X 4.5-5.7 µm), atris, clavatis, parietibus incrassatis. Setae fasciculatae, 125-230 X 4.5-6.8 µm, cylindraceae, septatae, basi tuberantes (11-12 µm), atrobrunneae, parietibus indistincte incrassatis (1.1-1.7 µm), apice angustato brunneoloque. Hyphae subiculiformes 3.4-4.6 µm, crassae, septatae (articulis 14-46 µm longis) parietibus indistincte incrassatis (1.1 µm). Asci 150-200 (p. sp. 115-175) X 12.5-16 µm, unitunicati, longe cylindraceo-clavati, stipitati (35-55 X 3.5-4.5 µm), annulo apicali simplici, refractivo et globulo apicalis glabroso vel indistincte verrucato instructi. Ascosporae biseriatae, 37-48(-68) X 3.5-4.5 µm, initio hyalinae, cylindraceae, sigmoideae, unicellulares; guttis oleiferentibus parvis magnisque; demum pars supera tumescens, clavata vel ellipsoidea, 15-18 X 6.8-8 µm, hyalina vel luteola, deinde brunneola, 1-2 (-4) cellularis. Pedicellus hyalinus, curvatus, 1-4 cellularis. Caudae 11.5-20.5 X 1.7-3 µm, gelatinosae, subulatae.

Etymology: from the Appalachian Mountains.

HOLOTYPUS: on wood, Jefferson National Forest, Giles Co., Virginia, USA, 14 Sept. 1985, leg. Ch. Gruhn & O. Hilber (BPI).

Perithecia 520-625 X 390-470 µm, superficial, solitary, in small groups or densely crowded, ovoid, black, densely covered by long, flaring, black, tramosericeous bristles; with subiculum-like dark, short, branched hyphae at the base.

FIG. 1. Cercophora appalachianensis. a. perithecia. b. peridium with Munk pores. c. subiculum-like hyphae. d. periphyses. e. setae.


2
a
b
c
d
10 µm
10 µm

Papillae 135-145 X 145-150 µm, broadly conical, black, glabrous to granular, not ridged, with a minute pore; perithecial contents of mucilaginous, grey material when moist, a thin, diaphanous, pale grey layer when dry. Peridium 60-80 µm, weakly gibbous, 2-layered. Outer layer 40-60 µm, brown, textura angularis, cells 10-25 X 7-18 µm, walls slightly thickened 1-1.7 µm, cells with numerous, scattered, bordered pit-like Munk pores; inner layer 20-25 µm, brownish, textura prismatica, cells 7-18 X 4.5-7 µm, thin-walled. Wall surrounding the ostiole of small, 4.5-9 X 4.5-5.7 µm, black, thick-walled cells. Bristles in clusters, 125-230 X 4.5-6.8 µm, cylindric, enlarged at base, 11-12 µm diam, slightly thick-walled, 1.1-1.7 µm, opaque blackish brown to brown, strongly tapering to the rounded apex, becoming translucent brownish. Hyphae of subiculum-like, distantly septate, cells 14-46 X 3.4-4.6 µm, slightly thick-walled, 1.1 µm. Asci 150-200, p. sp. 115-175 X 12.5-16 µm, unitunicate, long cylindric-clavate, stipitate (35-55 X 3.5-4.5 µm), slightly tapering to the apex (5.7-8 µm), where they are broadly rounded or truncate; with a simple, refractive, acyanophilous apical ring, 2.1-2.5 µm diam, neither amyloid nor chitinoid; subapical chamber not constricted, with a 4.5-7.5 X 4-4.5 µm, oval to globose, glabrous or slightly warty, plasmatic body. Ascospores biseriate. Paraphyses numerous, filiform, septate, segments 16-18 X 3.5-4.5 µm, slightly constricted at the septa; dissolving. Ascospores 37-48(-68) X 3.5-4.5 µm, hyaline, cylindric, sigmoid when young, ends broadly rounded; upper part clavate to ellipsoid when mature, 15-18 X 6.8-8 µm, hyaline, pale yellowish to brownish in age, 1-3 septate; lower part hyaline, curved, 0-3 septate. With large, robust, awl-shaped appendages on both ends 20.5 X 1.7-3 µm; plasmatic content granulate, (with numerous interspersed, large and small oil drops); germination either by germ

---

FIG. 2. *Cercophora appalachianensis*. a. ascus and paraphyses. b. ascospores. c & d. ascospores with germ tubes (c) and phialides (d).

tubes which can arise from all cells, occurring especially within the perithecia, or by large, lateral phialides, 6.8-8.5 X (1.7-)3.2-4.2 µm, seen outside the perithecia. Phialoconidia 2.6-3.7 µm diam, hyaline, drop-shaped.

Distribution: on bark and decorticated wood of *Tilia americana* and other hardwoods, as well as on old carpophores of polypores; especially in mountanous regions during fall -- USA.

Material examined: USA: Virginia; Giles Co., Pembroke, Jefferson National Forest, Little Stony Creek, on decorticated wood and bark of *Tilia americana*, 14 Sept. 1985, leg. Ch. Gruhn and O. Hilber, HOLOTYPE, VPI. ISOTYPES NY, CBS and Herb. Hilber, No. Vi 1. Illinois; exact substrate and locality unknown, 15 Aug. 1965, leg. Rogerson (as *Lasiosphaeria multiseptata* Earle ex Seaver). Virginia; Montgomery Co., Poverty Creek, on unknown decorticated hardwood, associated with *Coniochaeta* sp., 25 Sept. 1985, leg. Ch. Gruhn, BPI, Herb. Hilber No. Vi 11; Franklin Co., Booker T. Washington Natl. Monu., on decorticated wood of *Tilia* sp., 13 Oct. 1985, leg. O. Hilber, herb. Hilber No. vi 27; identical data, herb. Hilber No. Vi 28.

Observations: *Cercophora appalachianensis* is similar in habit to *Lasiosphaeria hispida* (Tode:Fr.) Fuckel. Twenty-three collections of *L. hispida* were studied and found to have larger ascospores than *C. appalachianensis*, 60-70 X 5.5-6(-7) µm. In addition, the ascospores of *L. hispida* have no appendages and no swollen head which is typical of the genus *Cercophora*.

Cercophora appalachianensis was compared with the remaining wood-inhabiting taxa of the genus *Cercophora* Fuckel (Hilber and Hilber, 1979, 1980) and the differences are detailed below:

1. *Cercophora ambigua* (Sacc.) R. Hilber and *C. arenicola* R. Hilber have habits which are similar to *L. hirsuta*. The large, brown fruitbodies of *C. ambigua* and *C. arenicola* are

sparsely hairy and distinctly warted. The ascospores of *C. ambigua* and are longer than those of *C. appalachianensis*.

2. *Cercophora caudata* (Curr.) Lundq. has immersed perithecia and lacks perithecial bristles. The ascospores are as long as those of *C. appalachianensis* but have a larger, swollen, upper cell.

3. *Cercophora costaricensis* (Carroll & Munk) O. Hilber & R. Hilber has glabrous perithecia and a pseudobombaradidoid peridium.

4. *Cercophora macrocarpa* (Carroll & Munk) O. Hilber & R. Hilber has large perithecia with distinct, ridged, star-like ostioles.

5. *Cercophora newfieldiana* (Ell. & Ev.) R. Hilber has perithecia which are densely covered with short hairs. The ascospores are small and narrow compared with those of *C. appalachianensis*.

6. *Cercophora sparsa* (Sacc. & Fairm.) R. Hilber has decumbent, hairy perithecia. The asci and ascospores are smaller than those of *C. appalachianensis*.

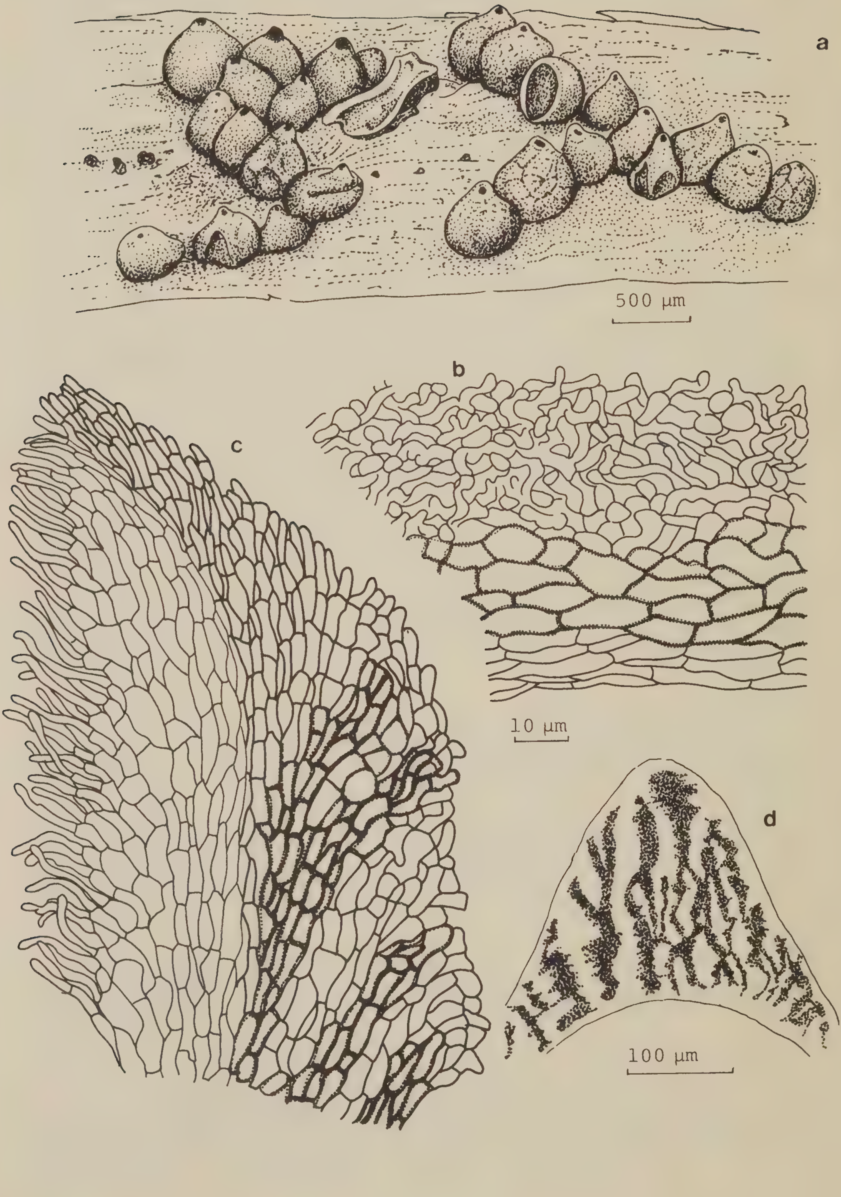
7. *Cercophora solaris* (Cooke & Ell.) R. Hilber & O. Hilber has glabrous perithecia, an areolate peridium and small ascospores.

8. *Cercophora sulphurella* (Sacc.) R. Hilber is characterized by perithecia with a yellowish green tomentum and a golden-yellow perithecial content.

Lasiosphaeria chrysentera Carroll & Munk
Mycologia, 56(1):83. 1964. Figs. 3,4.

Perithecia 520-675 X 310-570 µm, superficial, densely crowded in small to large groups or solitary; young with a white, scurfy to downy, areolate tomentum, later dirty white or brownish

3

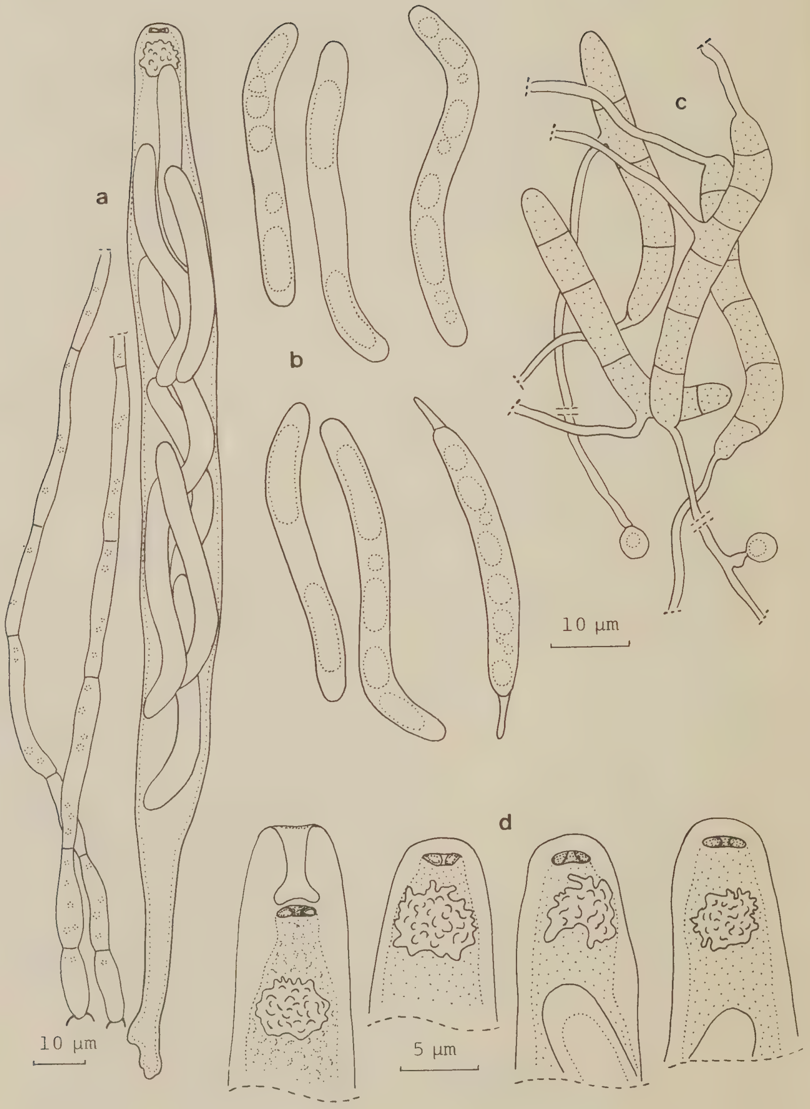

a
500 µm
b
c
10 µm
d
100 µm

to blackish brown, often connecting the perithecia. Papillae 160-210 X 70-100 µm at the apex, 135-250 µm at the base, conical, black, often with a thin, tomentose layer; perithecial contents consisting of a thin, golden yellow layer. Peridium 65-85 µm, stiffly coriaceous, fragile in age, yellowish brown, 3-layered, without Munk pores. Outer layer, the tomentum, 35-45(-65) µm, textura intricata of densely interwoven, ± hyaline, thin-walled hyphae 2-3.5 µm wide; middle layer 20-25 µm, textura prismatica-angularis of thin-walled cells 7-18 X 7-10 µm; inner layer 7-11(-15) µm, textura prismatica of thin-walled cells 10-23 X 2.3-3.5 µm, hyaline. Peridium of the ostiole with radiate, branched rows of black, carbonaceous cells in surface view; in longitudinal section about 45 µm wide, 2-layered. Outer layer alternately of rows with 3-10 X 2-4 µm, large, thin-walled, ochraceous cells and of opaque, blackish brown cells 5-8 X 1.5-2 µm which are slightly thick-walled, 1.1 µm. Inner layer 15-40 µm, textura prismatica-angularis of thick-walled, hyaline cells 15-20 X 1.5-2 µm. Periphyses 15-20 X 1.5-2 µm, hyaline, thin-walled, cylindric, terminal rounded, simple. Asci 150-205 p.sp. 105-135-(170) X (9-)11.5-16(-18) µm, unitunicate, cylindric-clavate, stipitate base, 20-37 X 3.5-5.8 µm, slightly pointed at the apex which is weakly truncate to broadly rounded; apical ring distinct, refractive, 2-2.6(-3.2) X 0.6-0.8 µm, inamyloid, not chitinoid; plasmatic content finely granulate, yellowish. Subapical chamber with a 2.5-5.5(-11) X 2.5-5(-9) µm large, globose to ovoid, irregularly warty, golden yellow plasmatic body. Ascospores biseriate. Paraphyses densely crowded, filiform, simple, septate, (segments 14-35 X 5 µm), pointed, apex 2.3-3.4 µm, constricted at the cross-walls, hyaline, in mass yellowish; with minute oil droplets. Ascospores (35-)38-45(-50) X 3.5-4.5(-5.7) µm,

---

FIG. 3. *Lasiosphaeria chrysentera*. a. perithecia. b. peridium. c & d. wall of the stiole in longitudinal section (c) and horizontal view (d).

4

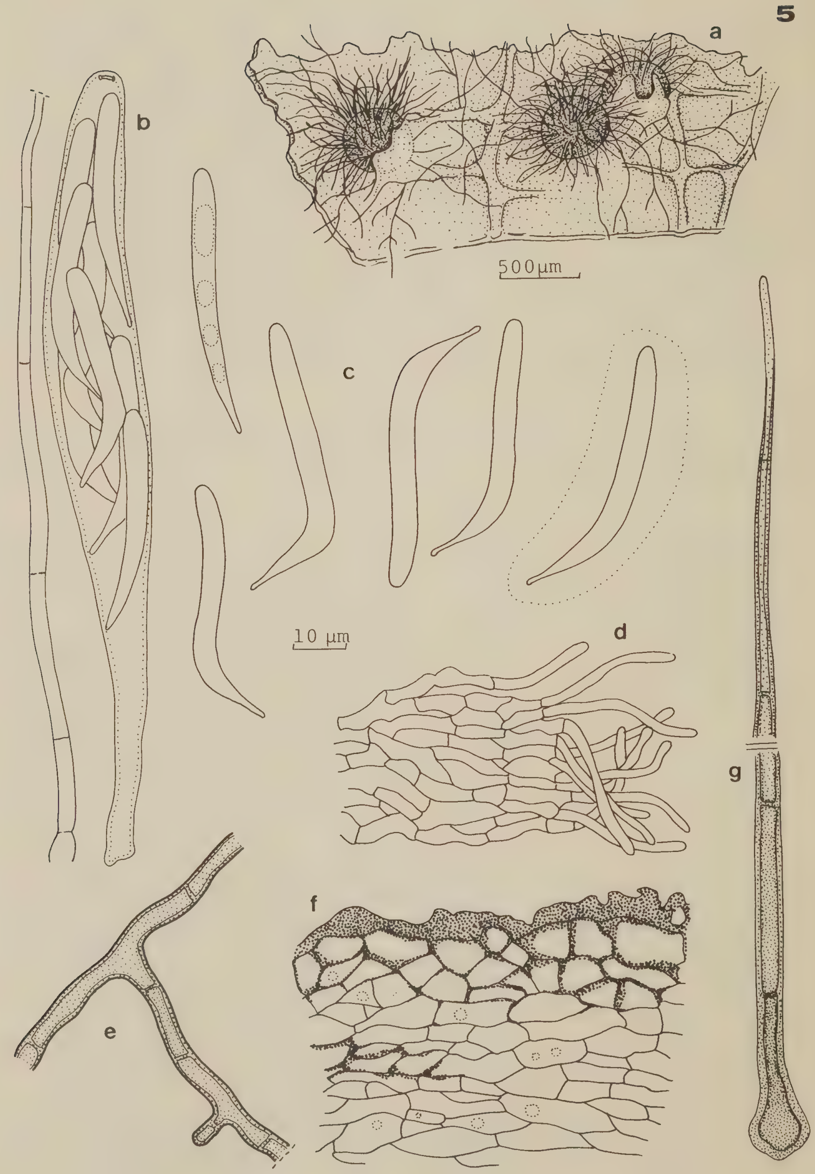

a
b
c
d
10 µm
10 µm
5 µm

hyaline to yellowish, one-celled to 3-septate, later (3-)6-septate, brownish, long cylindric, straight, curved, sigmoid, vermiform or curved near base; lower part 7-10(-14) µm, wall smooth, without a gelatinous sheath; contents with numerous, large and small oil drops. Appendages at each end 4.6-5.7(-6.8) X 1.7 µm, spiny, only visible in young spores. Germination occurs either by germ tubes within old perithecia or by phialoconidia outside of the perithecia. Germ tubes thin, 1.1 µm, hyaline, arise laterally or terminally from the ascospores, sometimes with short-stipitate, globose conidia (2.9-3.2 µm). Phialides 6.8-11.5 X 3 µm, flask-like, hyaline, arising laterally from the ascospores.

Distribution: on rotten wood of various deciduous trees; from June to Oct.; Costa Rica, Japan, USA.

Material examined: USA: New York; Yates (Gates?), on moist bark of rotten log (Basswood?) Oct. 1900, leg. Fairman (as *L. ovina* var. *aureliana*); Ridgeway, on prostrate trunk of *Tilia*, 16 Sept. 1904, leg. Fairman (as *L. ovina* var. *aureliana* = *L. ovina*); Lyndonville, Mothers woods, substrate unknown, Sept. 1927, leg. Fairman (as *L. ovina* var. *aureliana* = *L. ovina*); all in CUP-F. Vermont; Lamoille Co., Stowe, Ranch Brook trail near Mt. Mansfield, substrate unknown, 4 Aug. 1964, leg./det. Barr-Bigelow (Herb. Univ. Mass. No. 4471). Virginia; Montgomery Co., Pandapas Pond near Blacksburg, on rotten wood of *Tilia americana*(?), 7 Nov. 1985, leg. O. Hilber (Herb. Hilber No. Vi 47). COSTA RICA: near Vulcan Irazu (alt. 2000 m), 22 June 1962, leg. Carroll (NY, GC 85 - HOLOTYPE). JAPAN: Honshu, Yamanoashi Pref., Mt Fuji, Yoshido-guchi, Nakano-chaya, 1100-1200 m, 16 Sept. 1983, leg. Samuels (Herb. Plant Dis. Div., New Zealand, No. 46511).

FIG. 4. *Lasiosphaeria chrysentera*. a. ascus and paraphyses. b. ascospores. c. germinating ascospores. d. warty plasmatic body in the ascus.


5
a
500µm
b
c
10 µm
d
e
f
g

Observations: Lasiosphaeria chrysentera is closely related to L. ovina (Pers.:Fr.) Ces. & de Not. Differences are based on the tomentum, which is more areolate in L. chrysentera and very downy in L. ovina. In addition, the plasmatic body in the ascal apex is warty only in L. chrysentera. Carroll and Munk (1964) note "... surface of spores finely and irregularly pitted (visible under oil immersion)." This feature was not seen when the type material was studied.

Of interest is L. ovina var. aureliana Fairman (Fairman, 1904, Saccardo, 1905). Although we were not able to study its type we have examined three collections determined by Fairman as L. ovina var. aureliana. The first was collected in the same year and same month, Oct. 1900, as the type, but in a different locality and it is identical with L. chrysentera. The other two specimens are L. ovina. Therefore it is necessary to find and study the type of L. ovina var. aureliana for any nomenclatorial conclusions.

Lasiosphaeria sorbina (Nyl.) P. Karst. also has a whitish tomentum but the asci lack a warty plasmatic body. The shape of the ascospores is different than those of L. chrysentera and L. ovina. The perithecial content of L. sorbina (Nyl.) Karst. is pinkish in color.

Lasiosphaeria foliicola O. Hilber & R. Hilber, spec. nov. Fig. 5

Perithecia 600 X 300-400 µm, dispersa vel gregaria, subimmersa, globosa vel ovata, obscure fusca, pilis longis, brunneis, nitidis, patulis vel intricatis vestita, ostiolo atro-brunnea, conico, levigato, glabro, pilis occultato; contento subalbido diaphanoque. Hyphae subiculiformes leviter intricatae, accumbentes, fuscae.

Fig. 5. Lasiosphaeria foliicola. a. perithecia. b. ascus and paraphysis. c. ascospores. d. periphyses. e. hypha forming a subiculum-like net. f. peridium. g. hair.

Peridium 50-55 µm, brunneum, bistratum; cellulae externae 4.5-11.5 X 4.5-7 µm, brunneae, parietibus incrassatis (2.3-5.7 µm); cellulae strati secundi oblongae (11.5-20 X 3.5-5.5 µm), tenuiter tunicatae, hyalinae. Pili circa 900 X 1.7-2.3 (apice) -4.5-5.7 µm, basi 11-12 µm, septati, parietibus incrassatis, ad apicem tenuiter tunicati. Hyphae subiculiformes 4.5-5.7 µm, ramosae. Asci 135-175 (p.sp. 95-115) X 13.5-19.5 µm, unitunicati, cylindraceo-clavati, stipitati, annulo apicali simplici instructi, sine globulo subapicali. Ascosporae bi- vel triseriatae, basaliter uniseriatae, 40-45(-48) X 3.7-4.6 µm, hyalinae, unicellulares, cylindraceae, rectae vel sigmoideae, basaliter (11.5-16 X 3.4 µm) geniculatae, angustatae, apicibus spineis, 4-5.7 µm longis; interdum magnis guttis oleiferentibus et involucro mucoso, crasso (7 µm).

Etymology: folium (L.) = leaf; -cola (L.) = dwelling.

HOLOTYPUS: USA: Virginia, Giles County, Cascades, near Little Stony Creek, on dead leaves of Quercus sp., 1 Oct. 1985, leg. O. Hilber, BPI.

Perithecia 600 X 300-400 µm, solitary or in small groups, mostly with the lower third immersed, globose to ovate, dark brown; densely covered by long, brown, shining, flaring or interwoven hairs; papillae blackish brown, glabrous, smooth, broadly conical, 155 X 145 µm, hidden by the hairs. At the base, loosely interwoven, decumbent, subiculum-like, brown hyphae. Perithecial contents diaphanous, whitish when dry. Peridium 50-55 µm, brown, 2-layered. Outer layer 20-25 µm, a textura angularis, 4.5-11.5 X 4.5-7 µm, thick-walled (2-3 µm, at surface up to 4.5-5.7 µm), dark brown, without Munk pores. Inner layer about 30 µm thick, textura prismatica, cells oblong, 11.5-20 X 3.5-5.5 µm, thin-walled, hyaline, with many oil drops. Hairs up to 900 X 1.7-2.3 µm towards the apex, 4.5-5.7 um at the base enlarged to 11-12 µm; thick-walled, 2-3 µm, narrowly rounded, often septate, segments 35-43 µm. Subiculum-like hyphae 4.5-5.7

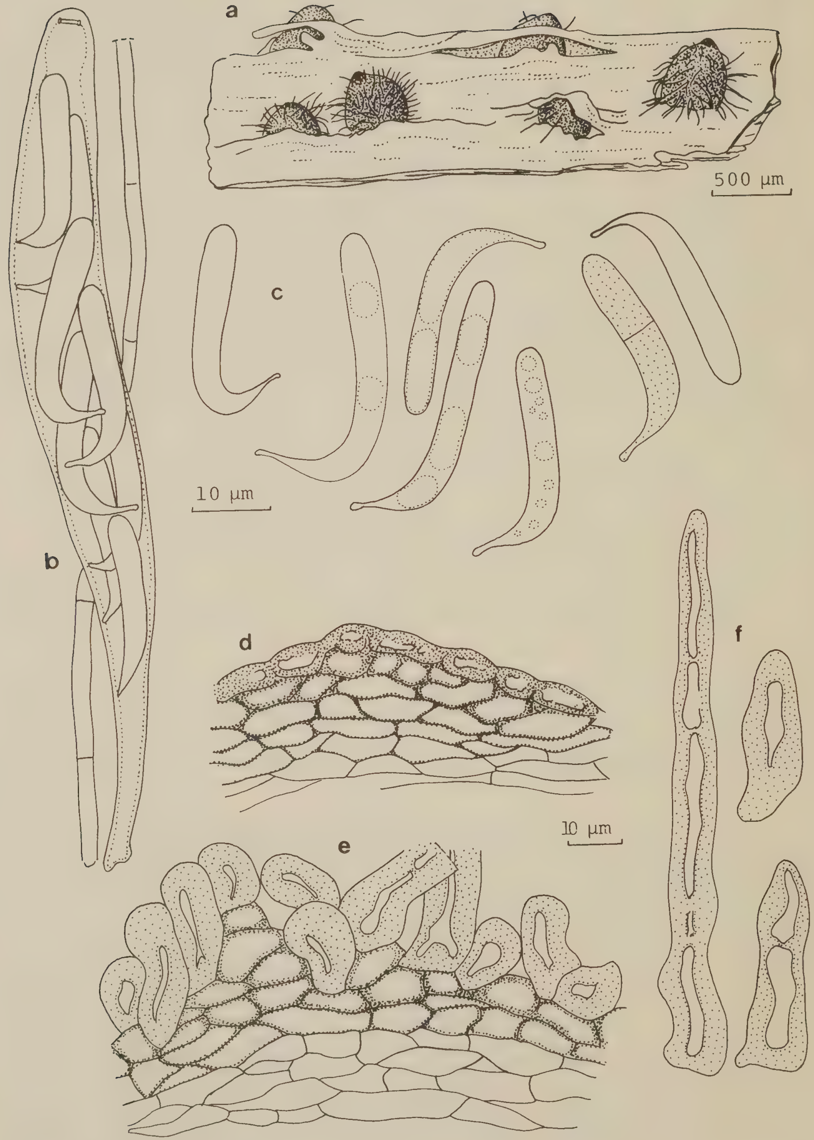
µm wide, thin-walled, dark brown, nearly opaque, branched. Periphyses 18-26 X 2 µm, hyaline, simple, broadly rounded at the apex, densely growing from large 5-11 X 3-3.5 µm, thin-walled cells of the inner ostiolar layer. Asci 135-175, p. sp. 95-115, X 12.4-19.5 µm, unituni-cate, long cylindric-clavate, stipitate, 45-65 X 4.5-5.5 µm; apex 6.5-7 µm, broadly rounded to truncate; apical ring simple, distinctly refractive, neither amyloid nor chitinoid, acyanophilous; subapical chamber and plasmatic body absent. Ascospores 2-3 seriate, uniseriate at the base. Paraphyses numerous, longer than the asci, delicate, hyaline, filiform, indistinctly septate, tapering toward the apex 2.3-4 µm diam. Ascospores 40-45(-48) X 3.7-4.6 µm, hyaline, one-celled, cylindric, straight, weakly sigmoid or obliquely geniculate, only curved in the lower third, 11.5-13.5(-16) X 3.4 µm, distinctly tapering with a long 4-4.5(-5.7) µm, spiny, basal tip; apex broadly rounded. Plasmatic content distinctly granular, often with large oil drops. Young ascospores often with a 7 µm thick, slimy envelope. Germination not seen.

Distribution: known only from the type locality.

Material examined: USA: Virginia; Giles Co., Cascades, near Little Stony Creek, on dead leaves of _Quercus_ sp., 2 Oct. 1985, leg. O. Hilber, HOLOTYPE, BPI.

Observations: _Lasiosphaeria foliicola_ is the second species of the genus _Lasiosphaeria_ described on dead leaves. The first, _L. phyllophila_ Mouton (1900) apparently doesn't belong to the Lasiosphaeriaceae due to its amyloid apical ring. This feature suggests a relationship to the Amphisphaeriaceae Winter thus linking the above mentioned families. _Lasiosphaeria phyllophila_ has allantoid spores in contrast to _L. foliicola_. In addition, _L. phyllophila_ has distinctly thick-walled bristles which are agglutinated into fascicles. The long, interwoven hairs are a distinct feature of _L._

6


a
500 μm
b
c
10 μm
d
10 μm
e
f

foliicola. The papillae of *L. phyllophila* are minute and indistinct. Most species in the genus *Lasiosphaeria* have stiff, flaring bristles or a tomentum of densely interwoven, hyaline hyphae. Some wood inhabiting taxa of the genus *Lasiosphaeria* have similar ascospores to those of *L. foliicola*. The striking feature of this spore type is a pointed basal end with a spiny tip. Taxa belonging to this group are *L. breviseta* P. Karst., *L. meznaensis* R. Hilber and *L. munkii* R. Hilber and O. Hilber. *Lasiosphaeria breviseta* has thick-walled bristles scattered over the surface of the perithecium. *Lasiosphaeria meznaensis* has 9-septate, large ascospores, 60-90 X 4.5-6 µm, and in *L. munkii* the perithecia have short, up to 150 µm, distinctly thick-walled bristles as well as small, distinctly curved ascospores, 25-32 µm. *Lasiosphaeria caudata* (Fuckel) Sacc. also has finely pointed ascospores but do not have spiny tips.

Lasiosphaeria munkii R. Hilber & O. Hilber,
sp. nov. Fig. 6.

Perithecia 250-470 X 350-420 µm, solitaria vel gregaria, semiimmersa vel superficialia, ovata vel globosa, atro-brunnea setis brunneis, longis brevibusque vestita; ostiolo indistincto, nigro, glabro; contento diaphano, luteolo. Peridium (15-)25-45 µm, gibbosum, fragile, bistratum, sine Munk poris. Stratum externum textura angularis cellulis 7-15 X 4.5-7 µm, ferrugineis, parietibus valde incrassatis (usque ad 4.6 µm); stratum internum textura prismatica cellulis oblongis (9-23 X 3.5-9 µm), dilute ferrugineis, tenui tunicatis. Setae 30-150(-329) X 6.8-11.5 µm (basi), ochraceae, parietibus distincte incrassatis (3.4-4.6 µm), septatae. Stratum externum ostioli cellulis 20-30 X 14-18 µm, clavatis, setiformibus, brunneis, parietibus valde incrassatis. Asci 105-115(-125)(p. sp. 60-90) X 10-15 µm, unitunicati, cylindraceo-clavati,

---

FIG. 6. *Lasiosphaeria munkii*. a. perithecia. b. ascus with paraphysis. c. ascospores. d & e. peridium, (d) from the immersed part. f. setae.

stipitati, annulo apicali simplici, distincte refractivo instructi; sine globulo subapicali. Ascosporae (18-)23-32 X 3.5-4.5(-5.5) μm, hyalinae, unicellulares; posterior interdum bicellulares, brunneae; cylindraceae, rectae, in quarta parte inferiore distincte curvatae et acutae, basi apice gongyloide; guttis oleiferentibus minutis magnisque.

Etymology: ad honorem Dr. Anders Munk, Danish mycologist.

HOLOTYPUS: on rotten wood, Pandapas Pons near Blacksburg, Montgomery Co., Virginia, USA, 6 June 1985, leg. O. Hilber (BPI).

Perithecia 250-470 X 350-420 μm, solitary or in small groups, up to half immersed, later free; ovoid to globose, brown; with short to long, flaring, brown bristles; papillae indistinct, black, glabrous, without ridges; perithecial contents dry with a thin, diaphanous, yellowish layer. Peridium (15-)25-45 μm, gibbous, fragile, 2-layered, without Munk pores. Outer layer 10-15 μm, dark ferrugineous, textura angularis, cells 7-15 X 4.5-7 μm, distinctly thick-walled, up to 4.6 μm. Inner layer 25-35 μm, ferruineous, textura prismatica, oblong cells, 9-23 X 3.5-9 μm; thin-walled. Bristles 30-150(-320) X 6.8-11.5 μm at base, 3.4-4.6 μm at apex, ochraceous with a narrow, septate lumen. Ostiolar region with numerous, brown, setiform, clavate, strongly thick-walled cells, 20-30 X 14-18 μm; ostiole 25 um diam. Periphyses hyaline, filiform. Asci 105-115(-125) (p. sp. 60-90) X 10-15 μm, unitunicate, cylindric-clavate, stipitate, 20-25 X 3.5-5.5 μm; apex 5.5-6 μm, rounded to truncate; apical ring strongly refractive, acyanophilic, inamyloid; subapical chamber weakly developed or not present; plasmatic body not seen. Paraphyses longer than the asci, filiform 2-2.5 μm diam. Ascospores (18-)23-32 X 3.5-4.5(-5.5)μm, hyaline, one-celled, cylindrical, straight, uni- to biseriate; the lower one-quarter to one-third distinctly curved in a right to acute angle, attenuate, with a (1-)2.3-3.4 μm long, spiny,

knob-like enlarged tip. Ascopores outside the perithecia pale brownish, 2-celled. Plasmatic content granular with dispersed large and small oil drops. Germination not seen.

Distribution: on rotten wood of deciduous trees in Europe and the USA; August to October.

Material examined: HOLOTYPE: USA; Virginia; Montgomery Co., Pandapas Pond near Blacksburg, on rotten wood of a deciduous tree, associated with *Hypoxylon* sp., 6 June 1985, leg. O. Hilber. DENMARK: Skovsgaard at Vibory; on wood of *Quercus* sp., 21 Aug. 1906, leg. Lind (as *L. caudata*), C.

Observations: *Lasiosphaeria munkii* is characterized by small, one-celled ascospores with a knob-like tip. Another distinctive feature is the peridium with both small and large bristles. This kind of peridium is also found in *L. caudata* (Fuckel) Sacc. The ascospores of the latter species are attenuate at the basal part, but lack a knob-like tip. The ascospores of *L. caudata* are large, 38-65 X 3.5-5.5 µm, aseptate to one or three septate, hyaline to dark brown. Furthermore *L. caudata* has a ridged, star-like ostiole which is not present in *L. munkii*.

The ascospores of *L. munkii* are similar to those of *L. breviseta* P. Karst. and *L. meznaensis* R. Hilber (Hilber and Hilber, 1983). The ascospores of the latter taxa are larger, have more cells, and are neither distinctly curved nor knob-like at the basal end. In addition, *L. munkii* has a 2-layered peridium while both *L. breviseta* and *L. meznaensis* have a 3-layered peridium.

Acknowledgments

We wish to express our appreciation to the curators of herbaria and scientists cited for providing specimens and information which made this study possible. In particular we thank Dr. Amy Rossman for reviewing the manuscript. We especially thank Hope Miller for editing, formating and typing the final manuscript.

Literature Cited

Carroll, G. C., and A. Munk. 1964. Studies on lignicolous Sordariaceae. Mycologia 56(1):77-98.

Fairman, C. E. 1904. Some New Fungi from Western New York. J. Mycol. 10:229-231.

Hilber, R. and O. Hilber. 1979. Einige Anmerkungen zu der Gattung *Cercophora* Fuckel (Lasiosphaeriaceae). Z. Mykol. 45(2):209-233.

Hilber, O. and R. Hilber. 1980. Beitrag zur Pilzflora des NSG Keilstein (2). Hoppea, Denkschr. Regensb. Bot. Ges. 39:107-111.

Hilber, O. and R. Hilber. 1983. Neue und seltene Arten der Gattung *Lasiosphaeria* Ces. & de Not. Sydowia 36:105-117.

Lundqvist, N. 1972. Nordic Sordariaceae s. lat. Symb. Bot. Upsal. 20:1-374.

Mouton, V., 1900. Quatrieme notice sur des Ascomycetes nouveaux ou peu connus. Bull. Soc. Roy. Bot., Belg., 39:37-53.

Saccardo, P. A., and D. Saccardo. 1905. Sylloge Fungorum 17:1-991.

MYCOTAXON

Vol. XXX, pp. 289-299 October-December 1987

MASSARIELLA: A DEBATED GENUS

A. Montemartini Corte
Istituto Botanico "Hanbury"
Università di Genova
Italia

Summary

The history of the genus Massariella Speg. (1880) with the sp. type M. bufonia (B. et Br.) is traced. According to this bibliographic analysis and the checking of exsiccata of original type, we exclude the possibility that Massariella Speg. is synonymous with Amphisphaeria Ces. et De Not. or with Pteridiospora Penz. et Sacc. Massariella is synonymous with Poikiloderma Fuisting (1868) being however solely represented by the species P. bufonium (B. et Br.) Fuist. Bearing in mind that on the other hand Massariella is represented by many species of which there are specimens in herbaria in all the world, I would propose that Massariella is considered "nomen conservandum".

The genus Massariella was created by Spegazzini (1880) distinguishing it from the gen. Massaria De Not. (1844) by the "ascosporae didymae" typified by the sp. Massariella bufonia (B. et Br.) Speg. Subsequently Spegazzini (1908, 1909, 1921) describes other species which belong to this genus, in the order: M. yerbae, M. monthae and M. trevoae.

Saccardo (1882-1913) considers the genus to be valid and makes new combinations: from Massaria: Massariella vibratilis (Fuck) Sacc., M. curreyi (Tul.) Sacc.; from Phorcys: M. berberidicola (Rehm)

Sacc. et Trott., M. lovereana (Rehm) Sacc. et Trott., M. eriophori (Feltg.) Sacc. et D. Sacc., and describes the new species M. acerina Sacc. et Syd., and quotes diagnoses of new species of various Authors: Casali, Curtis, Monton, Oudemans, Maffei, Tassi etc. Petrak also consider this genus to be valid, both by putting a specimen of it in his collection (1) and by claiming (1923) in chapter 209 of Massaria heterospora Ott., that the said species has nothing to do with Massariella bufonia (B. et Br.) Speg.

Recently, however, Müller and Arx (1962) consider Massariella Speg. to be synonymous with Amphisphaeria Ces. et De Not. In 1975 the same authors (Arx and Müller) maintain that Massariella can also be synonymous with Pteridiospora Penz. et Sacc. (1897).

As I consider this genus still valid, and Munk (1957) and Dennis (1981) share this opinion, in 1983 I described a new species: M. oleae associated with a bark canker on olive twigs.

In the same year (1983) Hawksworth, Sutton and Ainsworth give Massariella Speg. as the obligate synonym of Poikiloderma Fuisting (1868). To clarify this nomenclatural and taxonomic problem I have made a thorough bibliographic investigation and analysed various original types of herbarium.

Initially I examined the possible synonymy with the gen. Amphisphaeria. This genus was separated from the gen. Sphaeria sensu Persoon "vel ob sporidia didyma vel ex eo quod nonnullae species inter Lichenes Verrucarieos inter et Sphaerias ambigunt" by Cesati et De Notaris (January 1863).

Petrak (1923), while considering the description "ganz unzureichend", maintains that it is valid for Amphisphaeria umbrina (Fr.) Ces. et De Not., named as synonymous with the first A. cavata (Nyl.)

---

(1) Dr. F. Petrak "Fungi polonici exsiccati "Massariella bufonia (B. et Br.) Speg. (Herb.IMI 614)

by the same authors, and considers it to be the *typus* of the gen. *Amphisphaeria*. After having considered also *A. fallax* De Not. and *A. millepunctata* (Fuck.) Petrak valid species, he gives a more complete diagnosis of the genus, but does not mention sheathed spores.

Wakefield (1939) by differentiating *Sphaeropsis* Sacc. from *Sphaeropsis conica* Léveillé (1842) reconsiders the *Amphisphaeria conica* (Lév.) Ces. et De Not. combination, which thus becomes typus of *Amphisphaeria*. However neither to *A. conica*, nor to all the other *Amphisphaeria* described later (Seaver et Waterston 1942, Barghoorn et Linder 1944, Petrak 1953, Luc 1953) does anyone attribute sheathed ascospore except Müller et Arx (1962). In September of the same year (1863) in which Cesati and De Notaris made the said combinations, the Tulasne thorougly re-examined the gen. *Massaria*, stating that "in numero *Massariarum* isomerarum et quidem hoc in loco non absque jure forsan habetur *Sphaeria bufonia* B. et Br., cuius perithecia endophloea, globosa et vix millimetrum crassa, *Massariam curreii* nostram aemulantur, sed magis extant et densis congregari solent.".

Saccardo (1878) reproduces a clear drawing of "*Massaria bufonia* B. et Br." with didymous spores covered with hyaline sheath. Probably basing himself on the above mentioned "incidental mention" (art. 34.3 I.C.N.B.) of the Tulasne, Saccardo makes this combination for the first time, and therefore (Art. 42.2 and 44.2 I.C.B.N.) must be written *M. bufonia* (B. et Br.) Sacc. (1).

All specimens with the specific epithet "bufonia" obtained from various herbarium were examined; *Sphaeria bufonia* (Herb. Berk. 1879 IMI); *Amphisphaeria bufonia* (Herb. IMI 2612); *Massariella bufonia* (B. et Br.) Speg. (IMI 614) and some other spp. of

---

(1) The above explains why, in the exsiccata, *Massaria bufonia* often appears to have conflicting paternity.

Massariella: *M. currey* (Tul.) Sacc., *M. vibratilis* (Fuck.) Sacc. (Herb. Micol. H. Bot. Patavinus).

These types, which are very fragile and have dried pseudoparaphyses, have physoclastic asci (Furtado and Olive, 1971) and ascospores with very well preserved gelatinous perispores (Fig.1,2,3,4) and are very similar one to another; the ascospores which are still hyaline of the *Massaria bufonia* (from the Saccardian Herbarium of Padova) are unripe and therefore less comparable. Spegazzini's original exsiccata (Herb. et Ist. de Botanica "C.Spegazzini" La Plata) were also checked. The main characteristics of the gen. *Massariella*, also taken from Saccardo (1882), are confirmed by the *M. montheae* Speg. type (Fig. 5) and that of *M. trevoae* Speg. which are quite well preserved and corrispond to the descriptions of the Italo-American Author also in the appearance of the ascospores. *M. yerbae* Speg., despite having ascocarps and pseudoparaphyses similar to the preceding species, have ascospores which are too ripe where the sheath is not visible, even if at times, it seems to be dried in fragments on the spores. It would thus seem possible to conclude that the genus *Massariella*, typified by *M. bufonia*, is clearly defined by didymous ascospores with sheath.

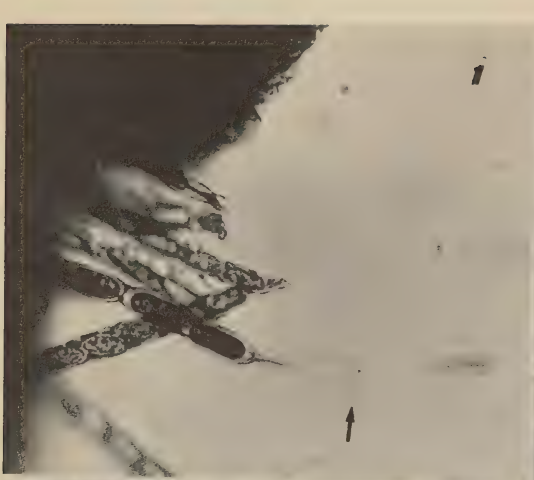
Fig. 1 - *Sphaeria bufonia* B. et Br. Ripe ascus with recognizable vanishing endotunica (arrow) and ascospores with sheath.

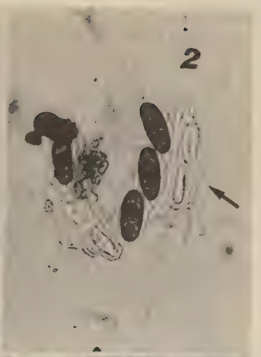
Fig. 2 - *Sphaeria bufonia* B. et Br. Ripe ascospores and empty sheaths (arrow).

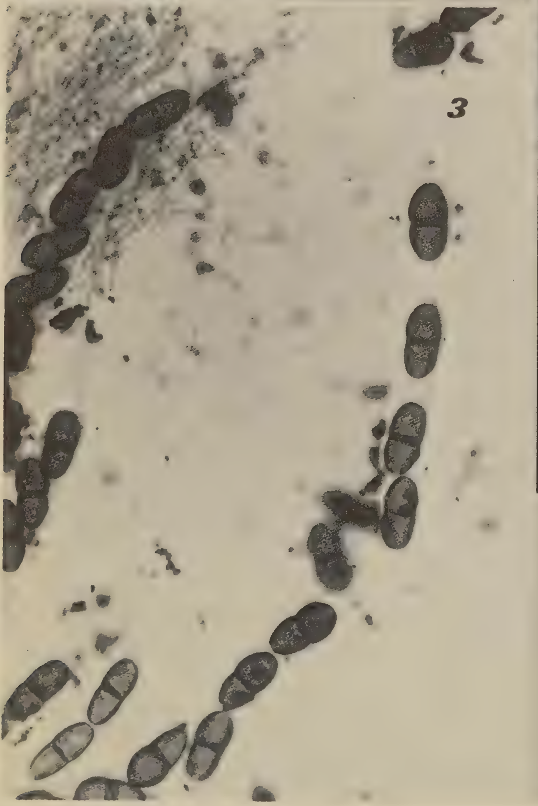
Fig. 3 - *Amphisphaeria bufonia* (B. et Br.) Ces. et De Not. Ripe ascospores with sheath.

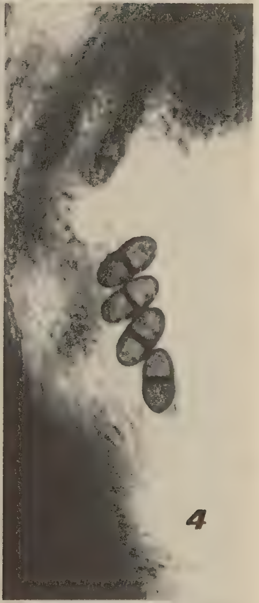
Fig. 4 - *Massaria bufonia* (B. et Br.) Sacc. Four ripe ascospores with sheath.

Fig. 5 - *Massariella montheae* Speg. Ascospore with sheath.


1


2


3


4

5

It is easier to exclude the synonymy, also facultative, with Pteridiospora Penz. et Sacc.(1897). The type of this genus P. javanica (1) has in fact in the ascomata, apically truncated asci containing elongated hyaline ascospores with asymmetrical sheaths which cover the spore giving it a spatulated appearance (Fig. 6 and 7). These spores are therefore completely different from those of Massariella which are dark, and frequently symmetrical, with a more homogeneous sheath and contained in elongated cylindrical asci. Also Filer (1969), who in fact has described other Pteridiospora does not consider Massariella.

In 1983 the synonymy of Massariella Speg. with Poikiloderma Fuisting (1868) appeared in the Dictionary of Fungi. The latter genus, even if it does not have a Latin diagnosis, was validly published (art.44.2 and 44.1 of the I.C.B.N.), but neither Fuisting's description nor his drawing give any information about the ascospores of their relative sheathes. However Fuisting typified that genus with "P. bufonium Berk. et Br." probably with reference to Sphaeria bufonia Berk. et Br., as confirmed by the Index nominum genericorum (1979),and there is an excellent description of the latter species and a very well preserved specimen.

In any case we tried to find original material of Poikiloderma bufonia (Berk.et Br.) Fuist.

The old herbarium of Leipzig, where the Botanische Zeitung was published in 1868, was destroyed during the Second World War (Index Herbariorum,

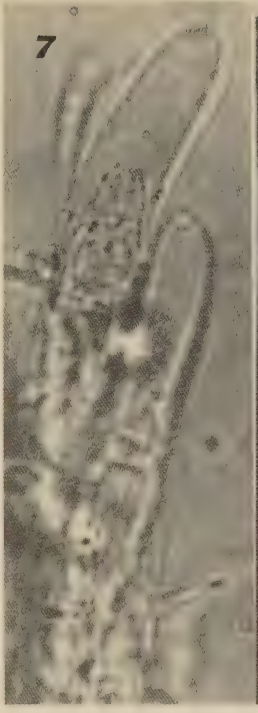
---

(1) Herb. Micol. H. Bot. Patavinus. P.A. Saccardo.

Fig. 6 - Pteridiospora javanica Penz. et Sacc. Photo of the original type and of the clear drawing by the authors.

Fig. 7 - Pteridiospora javanica Penz. et Sacc. Hyaline ascospore with asimetrical sheath.

6


7

1974). Dr. Gutte (1), who was asked about the possible existence of isotypes, confirmed that the material was nowhere to be found.

Massariella Speg. based on the same species, but only described later, is synonymous with Poikiloderma Fuist. Yet considering that all that remains of Poikiloderma is the description, and that on the contrary Massariella is very well represented by many species of which there are numerous exsiccata in herbaria in all the world, I would propose considering Massariella nomen conservandum.

This would also avoid putting the numerous species of Massariella in synonymy.

Given that the genus Massariella will be made valid, the problem of its classification remains. Having been created by Spegazzini by removal from Massaria De Not. it would automatically go with Massaria as defined by Munk (1957) and therefore in the Massariaceae Wint. em.Barr. (1979)or in the subfam. Massarioideae Wint.em. Eriksson (1981). In common with the Massariaceae it in fact has the fairly large ascoma, the peridium of numerous compact layers of small cells, large, thickwalled physoclastic asci, distoseptated spores which are covered, at least in the youthful phase, with gelatinous hyaline perispore. The only reason for uncertainty is given by the hamatecium (Eriksson l.c.). It is not easy to understand whether this preascal tissue is made up of trabecular pseudo-paraphyses (=paraphysoids) or by cellular pseudoparaphyses:in fact they are not easy to recognize in the numerous exsiccata examined, but they appear in the only fresh species in which the ontogenesis was followed septate, and cellular when young and easily deliquescent when ripe (Montemartini l.c.). This, following Barr's (1979 b) distinction of the Pleosporales from the Melanommatales also in consideration of the cellular and evanescent pseudoparaphyses of the first order of the narrow trabecular and anastomose ones of the last order, poses the problem of the classification of Massariella in order of the Pleosporales on the basis of the pseudoparaphyses or, in order of the Melanommatales on the basis of all the other characteristics mentioned. I would however tend to consider Massariella as a Massariacea and therefore in the Melanommatales.

---

(1) Curator of Herbarium of "Sektion Biowissenschaften der Karl Marx Universität, Leipzig".

Yet again it could be apt to consider the saying of Linnaeus "Natura non facit saltus", or to meditate on Corlett's opinion (1973) about the vast variability of the Pleospora centrum type.

Acknowledgment

I wish to thank Prof. D.L. Hawksworth (Kew), Prof. G.G. Lorenzoni (Padova) and Prof. J.C. Lindquist (La Plata) for having allowed me to examine the exsiccata.

Literature cited

Arx J.A. von and Müller E. 1975. A reevaluation of the bitunicate Ascomycetes with keys to families and genera. Stud. Mycol. 9: 1-159.

Barghoorn E.S. and Linder D.H. 1944. Marine fungi: theirtaxonomy and biology. Farlowia 1: 395-467.

Barr M.E. 1979 a. On the Massariaceae in North America. Mycotaxon 9: 17-37.

Barr M.E. 1979 b. A classification of Loculoascomycetes. Mycologia 71(5): 935-957.

Berkeley M.J. and Broome C.E. 1852. Notices of British Fungi. Ann. and Mag. Nat. Hist. 9:317-329.

Cesati V. et De Notaris G. 1863. Schema di classificazione degli Sferiacei italici aschigeri. Commentario Soc. Crittogam. Ital. 4: 177-240.

Corlett M. 1973. Observation and comment on Pleospora centrum type. Nova Hedwigia 24(2-4): 347-366.

Dennis R.W.G. 1981. British Ascomycetes. Cramer.

De Notaris G. 1844. Cenno sulla tribù de' Pirenomiceti Spheriacei e distribuzione di alcuni nuovi generi. Giorn. Bot. Ital. 1: 322-335.

Eriksson O. 1981. The families of Bitunicate Ascomycetes. Opera Botanica 60: 11-231.

Farr E.R., Leussink J.A. and Stafleu F.A. 1979. Index nominum genericorum. Vol.III (Peg-Zyz); Junk, The Hague.

Filer T.H. jr. 1969. New species of Pteridiospora. Mycologia 61(1): 167-169.

Füisting W. 1868. Zur Entwichelungsgeschichte der Pyrenomyceten III. Bot. Zeitung 23: 369-375.

Furtado J.S. and Olive L.S. 1970-71. Ascospore discharge and ultrastructure of the ascus in Leptosphaerulina australis. Nova Herwigia 19: 799-823.

Hawskworth D.L., Sutton B.C. and Ainsworth G.C. 1983. Dictionary of the fungi. 7th Ed. C.M.I. Kew, Surrey. 445 pp.

Holmgrem P.K. and Keuken W. 1974. Index Herbariorum Part I, ed. 6. Regnum Vegetabile 92: 1-397. Utrecht.

Luc M. 1953. Champignons graminicoles de Côte d'Ivoire. I° Pyrénomycètes. Suppl. Col. Rev. Mycologie XVIII (1): 1-37.

Maire R. et Werner R.G. 1937. Fungi Maroccani. Catalogue raisonné des champignons connus jusque ici en Maroc. Mém. Soc. Sc. Nat. Maroc XLV: 1-47.

Montemartini Corte A. 1983. Massariella oleae n.sp. associata ad un cancro corticale dell'Olivo. Phytopath. Medit. 22: 136-142.

Müller E. and Arx J.A. von 1962. Die Gattungen der didymosporen Pyrenomyceten. Beitr. Kryptogamenfl. Schweiz 11: 1-922.

Munk A. 1957. Danish Pyrenomycetes: A preliminary Flora. Dansk Bot. Ark. 17(1): 418-425.

Penzig O. e Saccardo P.A. 1897. Diagnoses fungorum

novorum in insula Java collectorum. Ser. I, Malpighia, 11: 387-409.

Petrak F. 1923. Mycologische Notizen IV: N° 209 e N° 298. Annales Mycologici, 21: 193-331.

Petrak F. 1953. Beitrage zur Pilzflora von Hawaii. Sydowia 7: 381-409.

Saccardo P.A. 1877-1886. Fungi italici autographice delineatis.N° 421. Patavii.

Saccardo P.A. 1882-1913. Sylloge Fungorum omnium hucusque cognitorum I-XXII - Patavii.

Seaver F. and Waterston J.M. 1942. Contribution to the Mycoflora of Bermuda III. Mycologia 34:515-524.

Spegazzini C. 1880. Fungi argentini. An.Soc.Cient. Arg. 9: 158-192, Tàb. 1-2.

Spegazzini C. 1908. An. Mus. Nac. Bs. As. 17: 123. fide Saccardo, Sylloge.

Spegazzini C. 1909. Mycetes argentinenses. An.Mus. Nac.Bs.As. 19, ser.III, t.XII: 257-458.

Spegazzini C. 1921. Mycetes chilenses. Bol. Acad. Nac. Sci. Cordoba. 25: 1-124.

Tulasne L.R. e Tulasne C. 1963. Selecta fungorum carpologia II: 1-319. Parisiis.

Voss E.G. et Al. 1983. International Code of Botanical Nomenclature. Congress, Sydney, 1981. Regnum vegetabile. Vol. 111. Utrecht.

Wakefield E.M. 1939. Nomina generica conservanda II. Trans. Brit. Mycol. Soc. 23: 281-292.

MYCOTAXON

Vol. XXX, pp. 301-318 October-December 1987

RECHERCHES SUR HEBELOMA (AGARICALES, CORTINARIACEAE). I. QUELQUES NOTES TAXONOMIQUES ET NOMENCLATURALES

LIVIO QUADRACCIA
Cattedra di Micologia, Dipartimento di Biologia Vegetale
Orto Botanico dell'Università di Roma "La Sapienza"
Largo Cristina di Svezia 24, 00165 Roma, Italie.

RESUME

La taxonomie et la nomenclature de quelques taxa du genre Hebeloma (Fr.) Kummer sont examinées. Une redescription extensive de H. fastibile (Pers. : Fr.) Kummer est fournie et pour H. sordidum R. Maire (= H. fastibile) un lectotype est designé. La synonymie entre H. angustifolium Britzelm., H. angustifolium Romagn. et H. tenuifolium Romagn. est discutée. Les nouveaux noms ou combinaisons suivantes: H. smithii Quad., H. sacchariolens Quél. var. pallidoluctuosum (Gröger et Zschieschang) Quad., sont introduites. Une nouvelle espèce, H. theobrominum Quad., est decrite.

Mots clés: Basidiomycotina - Agaricales - Cortinariaceae - Hebeloma - taxonomie - nomenclature.

SUMMARY

Researches on Hebeloma (Agaricales, Cortinariaceae). I. Some taxonomic and nomenclatural notes.

The taxonomy and nomenclature of some taxa of the genus Hebeloma (Fr.) Kummer are reviewed. An extensive redescription of H. fastibile (Pers. : Fr.) Kummer is provided and a lectotype for H. sordidum R. Maire (= H. fastibile) is designed. The synonymy among H. angustifolium Britzelm., H. angustifolium Romagn. and H. tenuifolium Romagn. is discussed. The following new names or combinations: H. smithii Quad., H. sacchariolens Quél. var. pallidoluctuosum (Gröger et Zschieschang) Quad., are introduced. One new species, H. theobrominum Quad., is described.

Key words: Basidiomycotina - Agaricales - Cortinariaceae - Hebeloma - taxonomy - nomenclature.

INTRODUCTION

Au cours de nos recherches monographiques sur le genre Hebeloma (Fr.) Kumm., nous avons tenu à apporter une mise au point ultérieure sur la taxonomie et la nomenclature de plusieurs entités de la section Hebeloma et de la section Denudata (Fr.) Saccardo. Parmi ces entités, se révèle d'une extrême importance Hebeloma fastibile (Pers. : Fr.) Kumm., en tant qu'espèce type du genre, pour laquelle existent, aujourd'hui encore, diverses conceptions taxonomiques, raison qui nous a conduit à donner notre description personnelle de H. fastibile, en espérant par là contribuer à la clarification de la délimitation de ce taxon.

Tout le matériel marqué de l'acronyme "ROHB" est déposé dans l'herbier de la Chaire de Mycologie, près le Jardin Botanique de l'Université de Rome "La Sapienza".

Les institutions scientifiques dont nous avons obtenu en prêt spécimens ou documents sont:

- Botanical Museum and Herbarium, Copenhagen, Denmark (C).
- Institut de Botanique, Université de Montpellier, Montpellier, France (MPU).
- Erbario cantonale, presso Museo Cantonale di Storia Naturale di Lugano, Lugano, Svizzera (LUG).
- Rijksherbarium, Leiden, The Netherlands (L).

PARTIE TAXONOMIQUE

1. **Hebeloma angustifolium** Britzelm., Hymen. Südbay. X: 166 (1894).

Synonymes: Hebeloma angustifolium Romagn., Sydowia 36: 258, 1983 (1984), non A.H. Sm. et al. (1983).
Hebeloma tenuifolium Romagn., Doc. mycol. 15(59): 53 (1985).

Hebeloma angustifolium Britzelm. est une espèce de sect. Denudata (Fr.) Sacc. subsect. Crustuliniformia Quad., très voisine de H. crustuliniforme (Bull.) Quélet. Recemment encore Romagnesi (1983, sorti de presse en 1984) a décrit une espèce avec le binôme "H. angustifolium", mais dans le cas concerné nous retenons qu'une telle entité serait en tous points identique à l'espèce décrite par Britzelmayr (1894) et pouvant donc être synonymisée avec elle. En effet, l'espèce de Romagnesi, tout comme celle de Britzelmayr, est très proche de H. crustuliniforme et présente comme caractère particulier des lamelles très étroites, viz. 2-4 mm de largeur (inde nomen); en outre il existe d'évidentes analogies entre les descriptions des deux Auteurs:

- Britzelm.: "...Hut gelblich fleischfarben, isabellfarben, Rand heller..."
- Romagn.: "Chapeau...pâle roussâtre, parfois même très pâle et blanchâtre au bord, puis ochracé brunâtre un peu roussâtre au centre...".
- Britzelm.: "...Stiel von der Farbe des Hutes, doch unten braun...".
- Romagn.: "...Stipe...blanc, puis un peu brunissant à la base...".
- Britzelm.: "...Lamellen sehr gedrängt, sehr schmal, gelbrötlich, gelblich lila, stets mit einem Stich ins Purpurfarbige...".

- Romagn.: "...Lamelles serrées...remarquablement étroites (2-4 mm) ...pâles, puis beige clair, beige roussâtre, argileux très pâle...".
- Britzelm.: "...Sporen 8, 10 : 4, 5, gelb...".
- Romagn.: "...Spores petites, 8.5-9.5-(11.5)x(4.7)-5-5.7-(7.5) µm...jaune clair...", mais dans la description latine: "...8.5-10-(11.5)x(4.7)-5-5.7-(7.5) µm...".

Enfin sont semblables également les représentations inconographiques fournies par les deux Auteurs.

Dernièrement Romagnesi (1985), prenant connaissance du binôme de Britzelmayr, probablement ne pouvant contrôler l'équivalence des deux entités, a introduit le nom nouveau de H. tenuifolium, en créant un ultérieur synonyme pour l'espèce de Britzelmayr.

Par contre Hebeloma angustifolium A.H. Sm. et al. (A.H. Smith et al., 1983) est une espèce Nord-Américaine appartenant à sect. Hebeloma subsect. Mesophaea A.H. Sm. et alii. Ce binôme est pourtant antédaté par H. angustifolium Britzelm. (op. cit.) et nous proposons en conséquence, pour la première espèce, le nom de **Hebeloma smithii** nom. nov. (basionyme: Hebeloma angustifolium A.H. Smith, Evenson et Mitchel, The veiled species of Hebeloma in the western United States: 164, 1983, non Britzelm. 1894 nec Romagn. 1984), en l'honneur du Prof. A. H. Smith, illustre mycologue américain.

Spécimen examiné:

- ITALIE, Altipiani di Arcinazzo (Roma), bois mixte, sous Quercus cerris L., Castanea sativa Miller et Picea abies (L.) P. Karsten, 7.X.1984, L. Quadraccia, no. 882 LQ (ROHB).

2. **Hebeloma fastibile** (Pers. : Fr.) Kummer, Führer Pilzkunde: 80 (1871).

Basionyme: Agaricus fastibilis Pers. : Fr., Syst. mycol. I: 249 (1821).

Synonymes: Agaricus fastibilis Pers., Syn. meth. fung.: 326 (1801), nomen devalidatum.

Hebeloma sordidum R. Maire, Bull. Soc. Mycol. Fr. 30: 212 (1914).

L'interprétation de Hebeloma fastibile dans les textes actuels est encore extrêmement confuse, puisque selon l'Auteur on trouve décrites diverses conceptions de l'espèce, souvent divergentes. Même dans les iconographies modernes, sont parfois représentés des échantillons difficilement attribuables à cette espèce, voire tout à fait différents, comme c'est le cas d'une publication récente à caractère vulgarisateur (Cetto, 1983), où, à la table 1332, se trouvent représentés, sous l'étiquette de H. fastibile, des exemplaires très typiques de H. edurum Métrod ex Bon. Du reste la conception de H. fastibile s'est révélée peu claire également dans le passé, et cette espèce a été souvent confondue par plusieurs Auteurs avec des entités de la sect. Denudata.

Persoon (1801) tout d'abord a décrit Agaricus fastibilis de manière succincte mais très précise, en dénombrant simultanément jusqu'à six variétés, certaines très différentes du type, signe évident de la connaissance encore vague des limites de l'espèce. Fries (1821) de son côté précisa dans sa description: "Varietates infinitae". De même Saccardo (1916) fit observer que: "Agaricus fastibilis Pers. è una specie collettiva, formata da parecchie caratterizzate dall'odore di rafano". Jusqu'à Malençon et Bertault (1970) qui, après la description de H. fastibile s.l., mentionnent à leur tour: "Tel qu'il est actuellement défini, l'H. fastibile est sans aucun doute composite...Elle s'écarte toutefois du type friésien dont elle n'a pas les lames pleurantes...". En effet, ce fut justement Fries (op. cit.) qui donna le premier une description non totalement conforme à la conception persoonienne de Agaricus fastibilis, en écrivant: "Lam. guttulas stillantes", alors que Persoon (op. cit.) avait indiqué: "...lamellis aquose cinnamomeis...", en substance lamelles "aqueusement" cannelle, pour la couleur cannelle "diluée". Persoon n'a jamais parlé de lamelles exsudant des goutteles aqueuses, sinon pour une variété "Agaricus fastibilis β. Agaricus circinans", pour laquelle il a décrit: "...lamellis albidis guttulas stillantibus, demum maculatis...". Et pourtant par la suite Fries (1830), dans un réexamen de A. fastibilis, se reféra clairement à une espèce "Indusiata": "...velo nempe, quod summi ponderis est..."; ce que confirme par ailleurs une représentation iconographique (Fries, Icon. Hymen. II, t.III, f.2, 1877) tout à fait conforme. En tout état de cause, Quélet (1888) confirma les lamelles "larmoyantes". De même fit Ricken (1915) qui, par-dessus le marché, décrivit et figura comme Hebeloma fastibile une espèce très semblable, pour ne pas dire identique, à H. crustuliniforme (Bull.) Quélet. Velenovsky (1920) cita jusque Agaricus fastibilis Pers. parmi les synonymes de H. crustuliniforme. Konrad et Maublanc (1924), tout en présumant dépeindre le vrai H. fastibile, dont par surcroît les caractères microscopiques correspondent parfaitement, le décrivent et le représentent avec des lamelles pleurantes et tachées par les spores (peut-être influencés en cela par les descriptions antérieures?). A.H. Smith et al. (1983) donnent encore une nouvelle interprétation du taxon, en effet, non seulement ils mentionnent des lamelles: "...at time beaded with hyaline drops of liquid", mais ils décrivent des spores de dimensions plus grandes "(9) 10-12 x 5,5-6,5 µm" et à profil plutôt amygdaliforme, en insérant H. fastibile au dehors de subsect. Mesophaea, à côté de H. testaceum (Batsch : Fr.) Quélet.

Enfin, de l'étude des specimens originaux de H. sordidum R. Maire (Maire, 1914), et de l'examen des documents manuscrits et des photos de Maire lui-même (L. Granel de Solignac comm.), nous estimons que H. sordidum et H. fastibile sont conspécifiques. Evidemment H. fastibile s. str. Maire devait être une espèce proche à H. crustuliniforme, comme on peut le déduire des observations de Maire (op. cit.), relatives à H. sordidum: "Cet Hebeloma est affine à Hebeloma fastibile (Fr.), dont il se sépare nettement par ses lamelles non pleurantes, peu emarginées, par

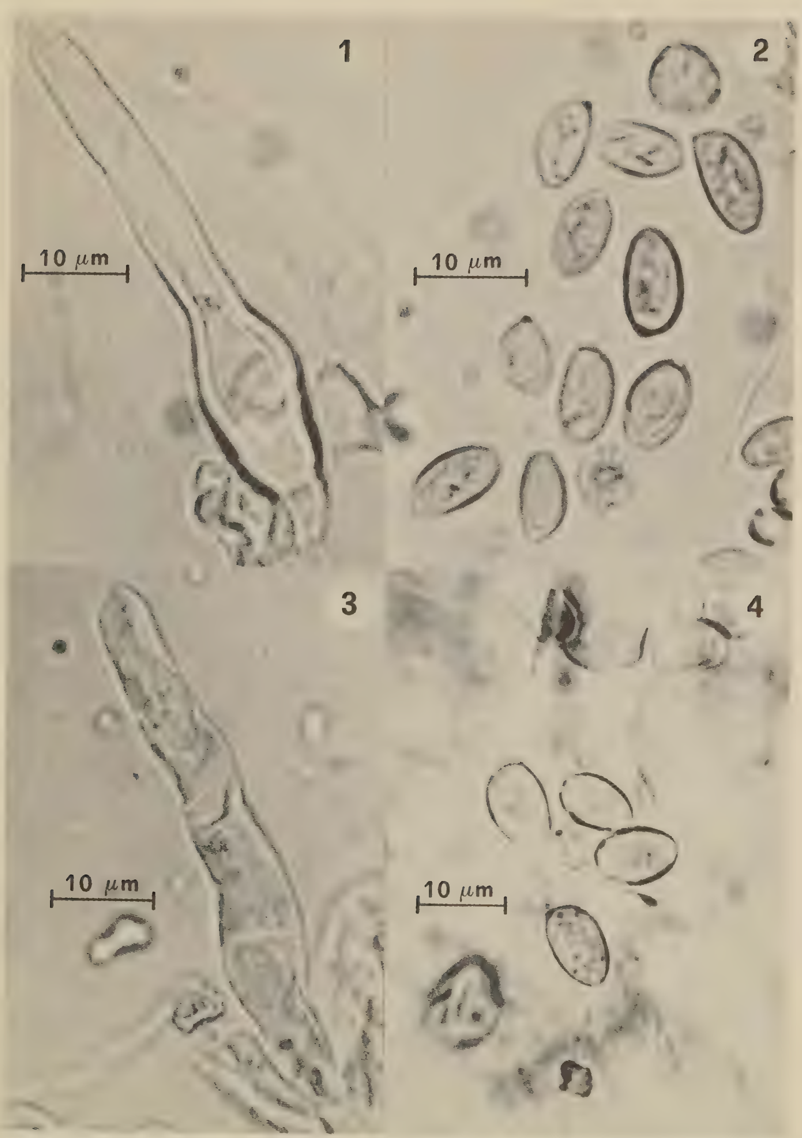

1
10 µm
2
10 µm
3
10 µm
4
10 µm

Fig. 1-4. Hebeloma fastibile: 1) cellule marginale, 2) spores (hb. Persoon, no. 910.258-593, L, lectotype); 3) cellule marginale, 4) spores (hb. R. Maire, s.n., MPU, lectotype de H. sordidum).

ses spores plus petites et sublisses".

Nous designons comme lectotype de H. sordidum la recolte: Algérie, Chréa, cédraies schistes, 1400-1500 m, 26.XI.1911, R. Maire, s.n., hb. R. Maire (MPU). Cette récolte paraît représentée, parmi les documents manuscrits de Maire, par une photo et un dessin, duquel trois exemplaires sont representés aussi dans le travail original.

Par ailleurs d'autres Auteurs, avec lesquels nous sommes en parfait accord, fournissent des descriptions qui reflètent fort bien la conception de Agaricus fastibilis exprimée par Persoon. Cooke (1881) offre une magnifique représentation de l'espèce en question. Mais c'est Lange (1938) qui fournit le premier une bonne description de ce champignon, jointe à une parfaite reproduction inconographique, spécifiant dans les notes qu'il n'a jamais observé des gouttelettes sur les lamelles. A sa suite, Kühner et Romagnesi (1953), Bruchet (1970) et Malençon et Bertault (1970), décrivent et parfois dessinent H. fastibile de manière remarquable, excluant la présence de gouttelettes sur les lamelles et écartant ainsi l'interprétation friésienne. Récemment Vesterholt et Weholt (1985) avancent l'hypothèse que H. fastibile peut être une forme robuste de H. mesophaeum; mais nous ne partageons pas ce point de vue. En effet H. fastibile nous semble pouvoir être distingué de H. mesophaeum, outre par la forme et les couleurs, semblables à H. crustuliniforme, par le stipe légèrement fuscescent à la base et le saveur à peine amarescente, par l'épicutis en ixoclatrus ("ixolattice" sec. A. H. Smith et al., 1983) et par la subcutis nettement hyphoïde, enfin par l'habitat principalement de montagne (autour de 1000 m d'altitude et plus), au moins en Europe centre-méridionale et en Afrique du Nord.

Pour notre part, après un examen attentif de la bibliographie concernant H. fastibile, conjointement à l'étude du matériel d'herbier et des échantillons récoltés par nous-même récemment, nous avons cru opportun de donner une redescription extensive du taxon, sans exclure pour autant le type original de Agaricus fastibilis Pers. (L!), désigné comme lectotype par Singer (1961):

Hebeloma fastibile (Pers. : Fr.) Kummer s. str. Quad.

Pileus (15)25-55 mm latus, carnosus, e convexo margine subinvoluto ad applanato-convexum, dein paene explanatus, umbone late obtuso et parum perspicuo et margine ex incurvo ad rotundatum. Cuticula aequalis, glabra, jove udo viscosa, margine iuvenum minute pruinoso, saepe circa marginem ornata vestigiis cortinae sparsis ac plus minusve firmis. Color in disco plerumque delutus et subaequalis, in medio pileo alutaceo-pallidus, ochraceo-fuscus vel ochraceo-leoninus, circa marginem ochraceo-cremeus, argillaceo-pallidus usque ad candidum in extremo circuitu. Lamellae confertae, modice latae (4-6 mm), adnexae vel sinuato-emarginatae, lamellulis interpositis sinuoso-rotundatis, semper siccae nec sporis unquam maculatae, acie minute erosa, pruinosa, albida; colore diluto, ex albido ad argillaceum, usque ad argillaceo-tabacinum

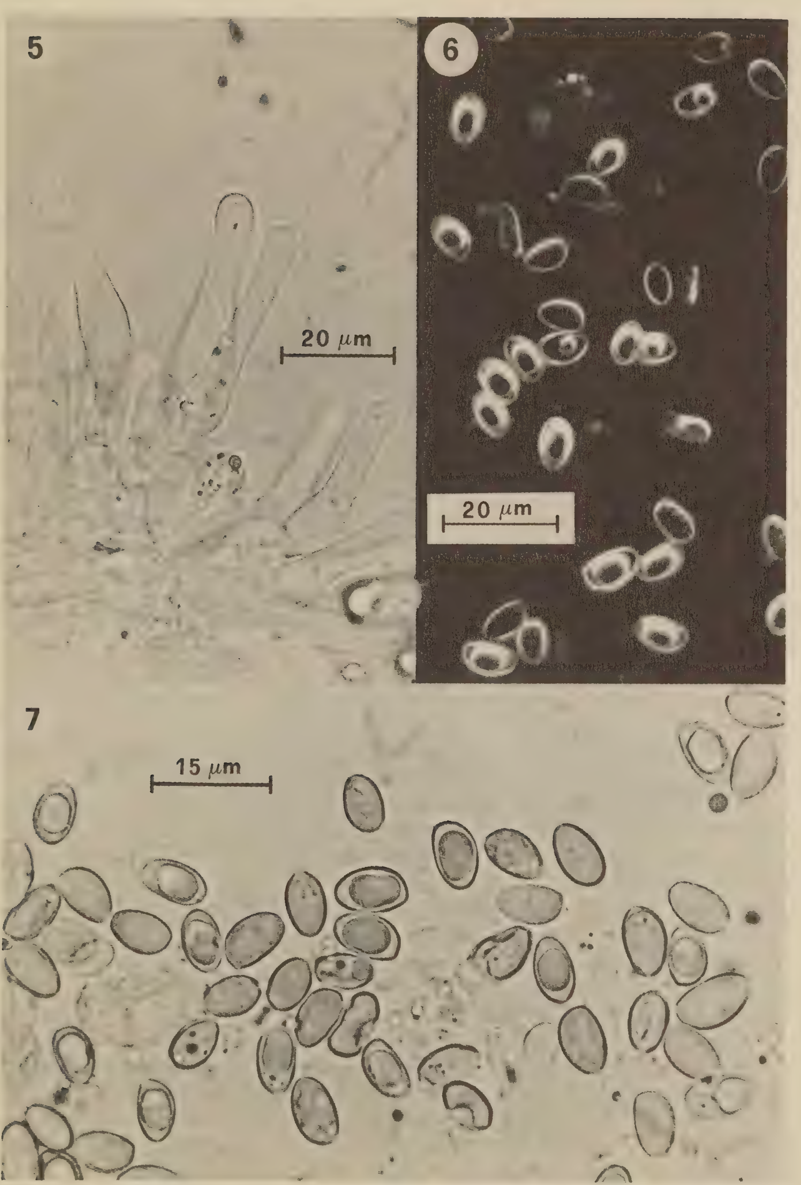

5
20 μm
6
20 μm
7
15 μm

Fig. 5-7. Hebeloma fastibile: 5) cellules marginales, 6) spores, 7) spores (no. 578 LQ, ROHB).

vel cinnamomeo-pallidum. Stipes 25-60 x (5)7-10 mm, validus, rectus vel subincurvatus, subaequalis vel basi parum incrassatus, fibrillosus, apice dense pruinoso-pulverulentus, perspicuis assiduisque cortinae vestigiis praeditus; fistulosus midullatus; aequabiliter albidus vel pileo subconcolor, basi subochraceo-fuscescens praesertim tactu. Cortina copiosissima, gossypina, ochroleuca, cuius vestigia diu extant manifesta. Caro in medio pileo valde crassa, albida, ad stipitis basim vix ochraceo-fuscescens; fere inodora in speciminibus recenter collectis, tenui odore raphanoideo in sectis; sapore subraphanoideo amariusculo. Sporae (7.5)8 - 10(10.5) x 5 - 6 µm, ovatae, apice obtuso, sblaeves vel punctatae, tenui colore flavo sub microscopio optico, non dextrinoideae. Basidia tetrasporica 25 - 35 x 7-8 µm. Cellulae marginales 30-50(65) x 6-12 µm, rectae vel geniculatae, basi ventricosae et superatae collo tenui culmine subobtuso, x 5-6.5 µm. Cellulae caulinares forma dissimiles: aliae cellulis marginalibus similes, sed maiores, 35-80(90) x 11-15 µm, apice x 5-7 µm lato; aliae subcylindraceae, 40-70 x 6-8 µm; aliae phyllocladiformes, 26-50 x 9-16 µm. Epicutis manifesta, gelificata (ixocutis), hyphis tenuibus gracilibusque constituta, x 2-4,5 µm latis; cutis parum perspicua; subcutis hyphoidea hyphis oblongis constituta, x 5-12 µm, tunicae pigmento membranae incrustatis, tenui colore flavo-aurato tincto. Fibulae adsunt.

Habitat praesertim in locis montanis, 1000-1900 metra supra mare, sub arboribus coniferis (Cedris, Piceis, Pinis) vel frondosis (Fagis, Quercubus), gregarius vel caespitosus.

Chapeau (15)25-55 mm, charnu, de convexe avec marge plutôt involutée, à plan-convexe, puis presque aplani avec mamelon obtus très large et peu distinct, marge d'incurvée à enroulée; surface uniforme, nue, visqueuse par temps humide; bord des sujets jeunes finement pruineux, souvent orné à l'extrémité de résidus épars et ± consistants de cortine; couleur dominante claire et presque uniforme, alutacé pâle, ocracé-brunâtre ou ocracé-fauve vers le centre, vers la marge crème-ocracé, argilacé pâle, jusqu'à blanchâtre à l'extrême bord.

Lamelles serrées, moyennement larges (4-6 mm), adnexées ou sinuées-émarginées, entremêlées de lamellules sinuées-arrondies, toujours sèches et jamais tachées par les spores, à arête finement érodée, pruineuse et blanchâtre; couleur claire, de blanchâtres à argillacées, jusqu'à brun-café au lait ou cannelle pâle.

Stipe 25-55 x (5)7-10 mm, robuste, droit ou légèrement recourbé, sub-égal ou un peu dilaté à la base; fibrilleux dans les trois-quarts inférieurs, densément pruineux-poudré au sommet, pourvu de résidus évidents et persistants de la cortine; medulleux-fistuleux à l'intérieur; uniformément blanchâtre ou sub-concolore au chapeau, légèrement ocracé-fuscescent à la base, surtout au toucher.

Cortine évidente, très abondante, cotonneuse, ocracé-blanchâtre, longtemps persistante sous forme de restes évidents.

Chair très épaisse au centre du chapeau, blanchâtre, légèrement

ocre-brun sale à la base du stipe: odeur sub-nulle à la récolte, faiblement raphanoïde à la coupe; saveur raphanoïde et à peine amarescente.

Spores (7.5)8-10(10.5) x 5-6 µm, ovoïdes, à sommet obtus; sub-lisses ou ponctuées; jaune très pâle sous le microscope; non dextrinoïdes.

Basides tétrasporiques 25-35 x 7-8 µm.

Cellules marginales 30-50(65) x 6-12 µm, droites ou géniculées, ventrues à la base et surmontées d'un mince col sub-obtus au sommet, x 5-6.5 µm.

Cellules caulinaires morphologiquement hétérogènes: certaines semblables aux cellules marginales, mais plus grandes, 35-80(90) x 11-15 µm, apex x 5-7 µm; d'autres sub-cylindriques 40-70 x 6-8 µm; d'autres encores phyllocladiformes, 26-50 x 9-16 µm.

Epicutis bien développée, gélifiée (ixocutis), constituée d'hyphes filiformes grêles, x 2-4 µm; cutis peu évidente; subcutis formée d'un hyphenchyme hyphoïde, constitué d'hyphes allongées, x 5-12 µm, incrustées d'un pigment membranaire jaune-doré pâle.

Boucles présentes.

Habitat: principalement lieux montagnards, 1000-1900 m d'altitude, en forêt conifères (Cedrus, Picea, Pinus) et feuillus (Fagus, Quercus), grégaire ou cespiteux.

Spécimens examinés:

- FRANCE, sine loc., hab. et die, C. H. Persoon, no.910.258-593, hb. Pers. (L), lectotype.
- ITALIE, Parco Nazionale d'Abruzzo, Villavallelonga (L'Aquila), loc. Aceretta, alt. 1250 m, sous Fagus sylvatica L., 26.VI.1983, L. Quadraccia, no. 578 LQ (ROHB); Monte Livata (Roma), alt. 1350 m, sous Fagus sylvatica L. et Pinus nigra Arnold, 29.X.1983, L. Quadraccia, no. 750 LQ (ROHB); Marsia (L'Aquila), alt. 1400 m, sous Fagus sylvatica L., 9.VII.1986, L. Perrone, det. L. Quadraccia, no. 1063 LQ (ROHB).
- SUISSE, Salorino, Monte Generoso (Ticino), alt. 1200 m environ, dans un bois de hêtres en terrain calcaire, 17.V.1981, A. Riva, det. L. Quadraccia, no. 1523 (LUG).
- ALGERIE, Chréa, cédraies schistes, 1400 - 1500 m, 26.XI.1911, R. Maire, ut Hebeloma sordidum Maire, s.n., hb. R. Maire (MPU), lectotype; Tenient-el-Haad, sous Cedrus, 20.XI.1912, R. Maire, ut Hebeloma sordidum Maire, no. 1018, hb. R. Maire (MPU); C. Batna, Djebel Touggour, sous les Cedrus, XI.1924, A. Nelva, det. R. Maire, ut Hebeloma sordidum Maire, no. 8469, hb. R. Maire (MPU).
- MAROC, Azrou, taillis à Quercus ilex du chemin de Ajellab, 1500 m alt., 22.X.1943, G. Malençon, det. R. Maire, ut Hebeloma sordidum R. Mre, no. 1396 et 1396 bis, hb. G. Malençon (MPU).

3. **Hebeloma sacchariolens** Quél. var. **pallidoluctuosum** (Gröger et Zschieschang) Quad., st. nov.

Basionyme: *Hebeloma pallidoluctuosum* Gröger et Zschieschang in Hirsch, Wiss. Ztschr. Friedrich-Schiller-Universität Jena, Naturwiss. Reihe 33 (6): 815 (1984).
Synonyme: *Hebeloma latifolium* Gröger et Zschieschang, Z. Mykol. 47 (2): 198 (1981), non P. Karsten (1898).

Dans l'excellent travail de Gröger et Zschieschang (1981) sur les entités de la subsect. *Sacchariolentia* Lange ex Bon, se trouve décrite une nouvelle espèce, très proche de *H. sacchariolens* Quél., dénommée *H. latifolium* Gröger et Zschieschang, binôme toutefois impossible vu l'existence de l'homonyme antérieur *H. latifolium* P. Karsten (1898), remplacé conséquemment par le nouveau nom de *H. pallidoluctuosum* Gröger et Zschieschang in Hirsch (1984).

A notre avis la distinction des deux entités, *H. sacchariolens* et *H. pallidoluctuosum*, operée par les Auteurs allemands, nous semble tout à fait opportune, mais non sur le plan spécifique.

Les caractères macroscopiques des deux taxa sont presque identiques; quant aux lamelles très larges qui, selon Gröger et Zschieschang (op. cit.) seraient typiques de *H. pallidoluctuosum*, nous les avons aussi retrouvées souvent dans *H. sacchariolens*, viz. 9-10 mm de largeur.

L'habitat non plus ne semble séparer les deux entités de facon décisive, du fait que sur terrain neutre et sableux-siliceux nous les avons trouvées réunies.

Les caractères microscopiques suffisent à mieux distinguer les deux champignons, en ce que les cellules marginales de *H. pallidoluctuosum*, très souvent lagéniformes, ne dépassant jamais les 50 µm de longueur, alors que dans *H. sacchariolens* elles sont distinctement clavées-capitulées et atteignent jusqu'à 80-90 µm; cependant les spores des deux sont presque semblables.

De telles considérations nous induisent à penser que *H. pallidoluctuosum* est un phénotype de *H. sacchariolens* var. *sacchariolens*, comme *H. sacchariolens* var. *tomentosum* Mos. (Moser, 1970), et pour cette raison nous proposons la nouvelle combinaison: *H. sacchariolens* var. *pallidoluctuosum*. Cette dernière veriété, dans le passé, a été souvent rapportée avec l'épithète de "*sacchariolens*" (viz. *H. sacchariolens* auct. non Quélet 1879: i.e. Konrad et Maublanc, Icon. Fung. 1: t.81-I, 1924; Bresadola, Icon. mycol. 15: t.719, 1930; Michael et Hennig, Handb. Pilz. 4: t.31, 1967), probablement à cause de son ample diffusion; en fait en Italie elle s'y est montrée plus commune et moins hygrophile que le type, spécialement dans les régions centro-septentrionales (Latium, Toscane, Ombrie, Emilie-Romagne, Lombardie), ou elle se rencontre fréquemment dans les bois mésophiles (Querco-Carpinetum) ou thermophiles (Quercion ilicis).

Spécimens examinés:

- FRANCE, Chens-sur-Léman (Haute-Savoie), dans un taillis, sous *Quercus robur* L. et *Ostrya carpinifolia* Scop., 10.X.1984, L. Quadraccia, no. 889 LQ (ROHB); ibid., dans un bois mixte, sous *Quercus*, 10.X.1984, P.Giossi,

det. L. Quadraccia, no. 899 LQ (ROHB).
- ITALIE, Bosco del Padiglione (Roma), à proximité d'une mare temporaire, sous *Quercus cerris* L. et *Q. frainetto* Ten., 14.X.1979, L. Quadraccia, no. 172 LQ (ROHB); Castelporziano (Roma), sous *Quercus cerris* L., *Q. frainetto* Ten. et *Q. robur* L., 15.X.1982, L. Quadraccia, no. 519 LQ (ROHB); ibid., sous *Quercus suber* L., 30.X.1986, L. Quadraccia, no. 1103 LQ (ROHB); Parco di Monza (Milano), sine hab., X.1984, G. Imperatori, det. G. Lucchini, no. 3445 (LUG), (id., no. 822 LQ, ROHB); Bosco di Manziana (Roma), sous *Quercus cerris* L. et *Q. frainetto* Ten., 16.X.1984, L. Quadraccia, no. 922 LQ (ROHB); ibid., sous *Quercus robur* L., 29.X.1986, L. Quadraccia, no. 1091 LQ (ROHB).
- SUISSE, Muzzano, Agnuzzo (Ticino), sur sol semi-marécageux, sur le bord du Lac de Lugano, avec *Alnus*, *Platanus*, *Salix* et *Quercus coccinea* Muench., 20.X.1978, G. Lucchini, det. L. Quadraccia, no. 63 (LUG), (id., no. 830 LQ, ROHB).

4. **Hebeloma theobrominum** Quad., sp. nov.

Pileus 30-45(55) mm latus, carnosus, elasticus, non parum abnormis, primitus subhemisphaericus margine involuto, mox convexus, dein quasi applanatus, semper lato umbone obtuso praeditus et margine ex incurvo usque ad inflexum, interdum mediocriter gibbosus et margine subsinuato. Cuticula aequalis, glabra, subviscosa, paene rore albido nitens. Margo in iuvenibus subpruinosus et mediocriter sulcatus. Color fere aequalis, cacainus, rufo-cacainus, badius, interdum in disco subpallescens, paene avellaneo-ochraceus. Lamellae confertae, haud latae (3-5 mm) rotundato-adnexae, lamellulis subtruncatis interpositis, siccae vel subplorantes guttulas aquosas in iuvenibus, sed nunquam sporis maculatae, acie minute crenulata, pruinosa, albida, colore plerumque claro, ex albido ad fusco-ochraceum pallidum usque ad argillaceo-brunneolum vel ochraceo-ferrugineum, interdum cretaceo-incanum. Stipes 30-50 x 7-10(12) mm, solidus, subcylindraceus, nonnunquam basim versus modice attenuatus; plane fibrilloso-striatus, dense pruinosus de summo paene ad infimum, densa pruina conspersus; plenus vel fistuloso-cuspidatus; aequabiliter candidus albidusve vix fuscescens. Cortina nulla in ipsis immaturis speciminibus. Caro pilei plane alba, vix stipitis fuscescens praesertim in basi; odore subraphanoideo in speciminibus recenter collectis, raphanoideo in sectis; sapore raphanoideo subamaro. Sporae (8)8.5-10.5(11) x 4.5-5.5 µm, amygdaliformes elongate, apice saepe oblongo-papillato, laeves vel puncticulatae in ammoniae hydroxido, kalii hydroxido et chloralii hydroxido, tenui colore flavo sub microscopio optico, dextrinoideae. Basidia tetrasporica 25-30 x 7-8 µm. Cellulae marginales (20)30-45(60) x 4-6 µm, subcylindraceae vel clavato-capitulatae saepe apice incrassatae, x 7-9 µm. Cellulae caulinares marginalibus similes, sed maiores et magis clavato-capitulatae. Epicutis contextu ixotrichodermico, hyphis subtilibus composito (x 3-5 µm latis), cellulis terminalibus manifeste clavatis (apice x (4)5.5-7 µm), sparsis;

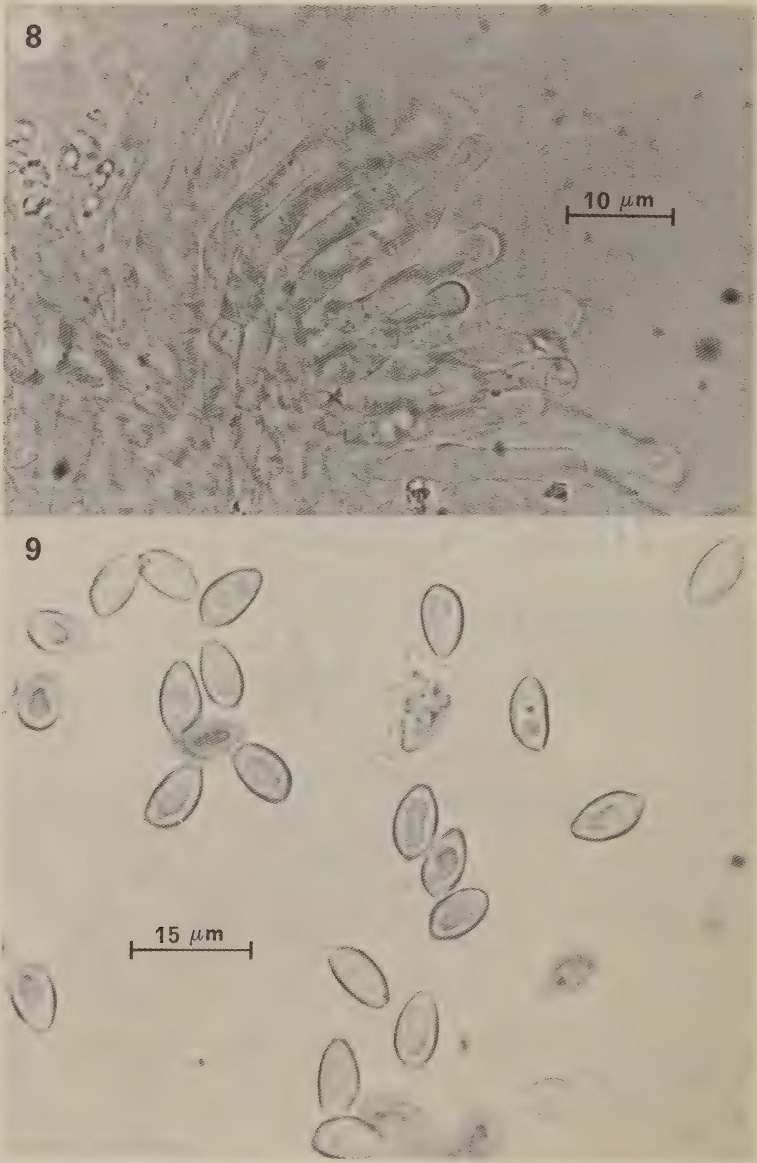

8
10 μm
9
15 μm

Fig. 8-9. Hebeloma theobrominum: 8) cellules marginales, 9) spores (no. 925 LQ, ROHB, holotype).

ERRATA, VOLUME THIRTY

Page 313	line	14	*for*	Knudsen,	*read*	Knudsen ut *Hebeloma truncatum* (Fr.) Kumm. ss. Lange,
316	line	14	*for*	Knudsen,	*read*	Knudsen ut *Hebeloma truncatum* (Fr.) Kumm. ss. Lange,

cutis parum distincta pseudocollenchymatica; subcutis valde manifesta, typice pseudoparechymatica hyphis composita pigmento membranario incrustato vivide tinctis brunneo-rufescenti vel aurantio-rufescenti. Fibulae adsunt.

Habitat in phytocenosis eliophilis (id est in silvis raris, caeduis vel in earum margine) sub arboribus coniferis (Piceis, Pinis) vel frondosis (Carpinis, Ostryis, Quercubus), gregarius at saepe solitarius.

Holotypus: Italia, prope Manziana (Roma), in querceto lectus, 16.X.1984, leg. L. Quadraccia, in herbario Auctoris apud Hortum Botanicum Universitatis Romae conservatur, no. 925 LQ (ROHB).

Paratypi: no. 902 LQ (ROHB); no. 820 LQ (ROHB) (isoparatypus in Helvetia apud Museum Cantonalem Historiae Naturalis Lucani conservatur, no. 3550, LUG); in Dania apud Museum Botanicum Havniense conservatur, Sjaelland, Jaegersborg Dyrehave, sine hab., 6.IX.1980, sine coll., det. H. Knudsen, s. n. (C).

Chapeau 30-45(55) mm, charnu, élastique, plutôt irrégulier, d'abord subhémisphérique avec marge enroulée, bientôt convexe, puis presque plan, toujours avec mamelon obtus et marge d'incurvée à infléchie, parfois légèrement gibbeux et à marge un peu sinueuse; surface uniforme, nue, peu visqueuse, d'aspect presque glacé; bord des individus jeunes un peu pruineux et légèrement cannelé; couleur quasi uniforme, brun-cacao, cacao-rougeâtre, marron-fauve, quelquefois un peu pâlissant au centre, presque brun-café au lait.

Lamelles serrées, pas très larges, arrondies-adnexées, intercalées de lamellules sub-tronquées; sèches ou sub-larmoyantes (gouttelettes aqueuses dans les individus jeunes), toutefois jamais tachées par les spores; arête finement crénulée, pruineuse et blanchâtre; couleur en général claire, de blanchâtres à brun-ocre pâle, jusqu'à brun argilacé ou ocre-ferrugineux, parfois avec tons grisâtres.

Stipe 30-50 x 7-10(12) mm, ferme, sub-cylindrique, parfois un peu atténué à la base; complètement fibrilleux-strié, densément pruineux depuis le sommet presque jusqu'à la base; intérieurement plein ou fistuleux-cuspidé; uniformément blanc pur ou blanchâtre à peine fuscescent.

Cortine nulle, même sur les individus jeunes.

Chair parfaitement blanche dans le chapeau, à peine fuscescente dans le stipe (spécialement à la base), ne brunissant pas fortement; odeur faiblement raphanoïde à la récolte, raphanoïde à la coupe; saveur raphanoïde un peu amarescente.

Spores (8)8.5-10.5(11) x 4.5-5.5 µm, amygdaliformes-allongées, souvent à sommet allongé-papillé; lisses ou finement punctuées dans l'ammoniaque, la potasse et le chloral; jaunâtre pâle sous le microscope; dextrinoïdes.

Basides tétrasporiques 25-30 x 7-8 µm.

Cellules marginales (20)30-45(60) x 4-6 µm, sub-cylindracées ou clavées capitulées, fréquemment dilatées à l'apex, x 7-9 µm.

Cellules caulinaires semblables à celles de la marge, de dimensions

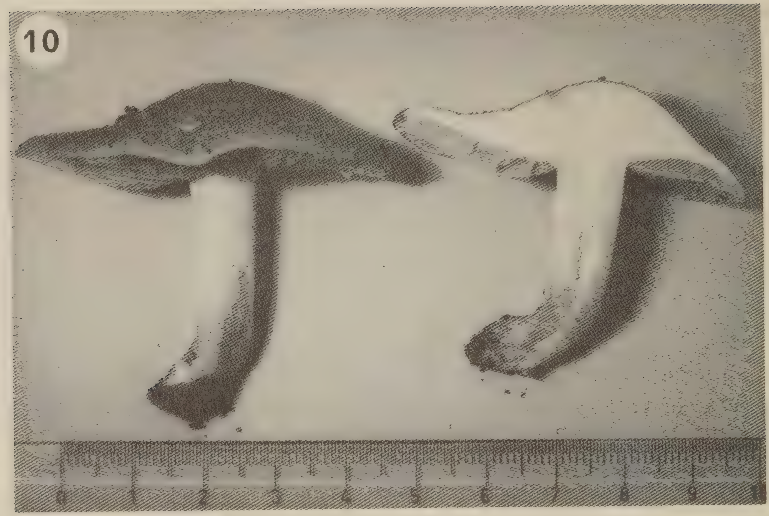

10
0 1 2 3 4 5 6 7 8 9 10

Fig. 10. *Hebeloma theobrominum*: holotype, no. 925 LQ, ROHB.

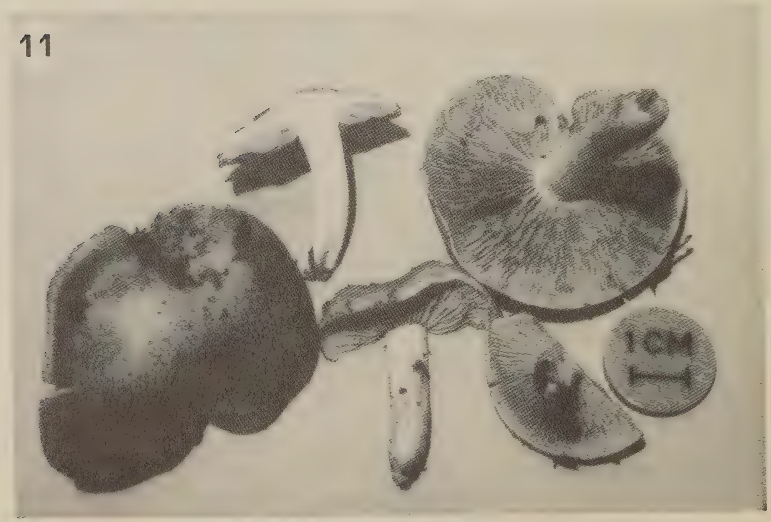
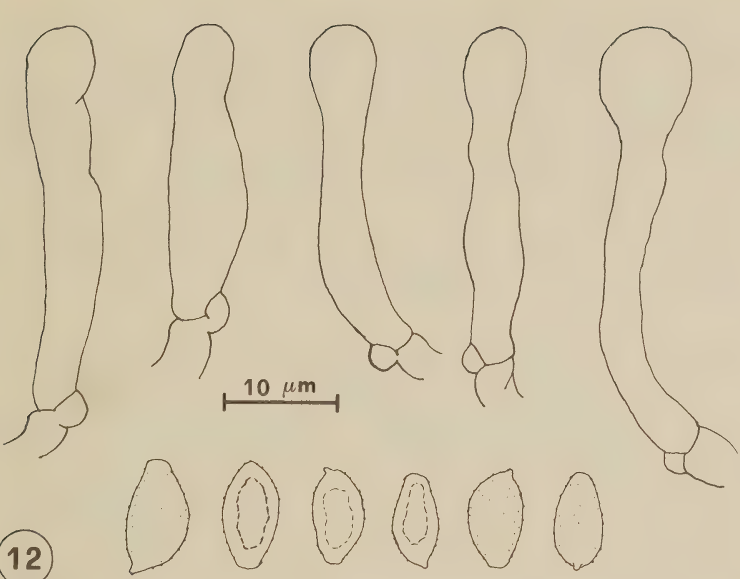
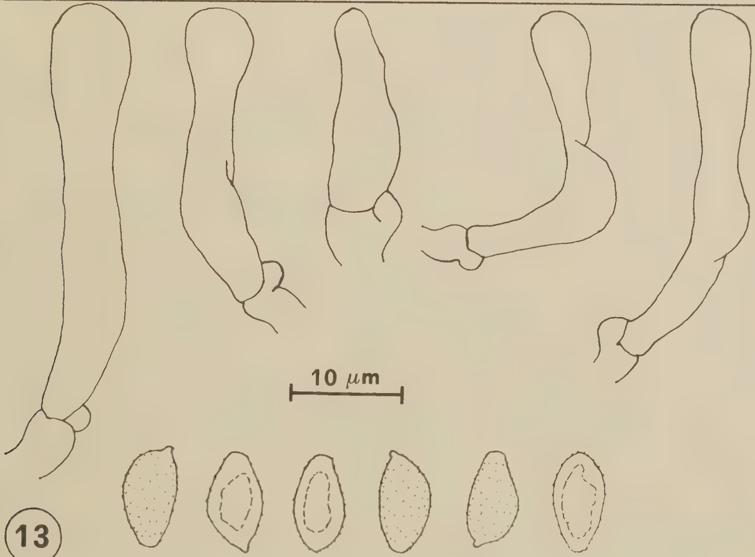


Fig. 11. *Hebeloma theobrominum*: paratype, no. 820 LQ, ROHB (photo G. Lucchini).



12



13

Fig. 12-13. *Hebeloma theobrominum*: 12) cellules marginales et spores (no. 925 LQ, ROHB, holotype); 13) cellules marginales et spores (no. 820 LQ, ROHB, paratype).

SEE ERRATA

plus grandes et davantage clavées-capitulées.

Epicutis à structure ixotrichodermique, formée d'hyphes minces (x 3-5 µm), terminées par des cellules manifestement clavées (apicalement x (4)5.5-7 µm), disséminées; cutis peu différenciée pseudocollenchymatique; subcutis très nette, typiquement pseudoparenchymatique, avec hyphes vivement colorées par un pigment membranaire zébrant, brun-rougeâtre ou orangé-rougeâtre.

Boucles présentes.

Habitat: phytocénoses héliophiles (bois clairs, bois taillis ou leurs lisières), sous conifères (*Picea*, *Pinus*) ou feuillus (*Carpinus*, *Ostrya*, *Quercus*), grégaire mais souvent solitaire.

Spécimens examinés:

- DANEMARK, Sjaelland, Jaegersborg Dyrehave, sine hab., 6.IX.1980, sine coll., det. H. Knudsen, s. n. (C), paratype.
- FRANCE, Chens-sur-Léman (Haute-Savoie), dans un taillis, sous *Quercus robur* L. et *Ostrya carpinifolia* Scop., 10.X.1984, L. Quadraccia, no. 902 LQ (ROHB), paratype.
- ITALIE, Bosco di Manziana (Roma), bois clairs, sous *Quercus cerris* L. et *Q. frainetto* Ten., 16.X.1984, L. Quadraccia, no. 925 LQ (ROHB), holotype; Olmi, loc. Sonnenhof, Aldino (Bolzano), sine hab., 18.VII.1981, F. Bellù, det. L. Quadraccia, no. 820 LQ (ROHB), paratype, (id., no. 3550, LUG, isoparatype).

H. theobrominum correspond à *H. firmum* sensu Ricken (1915), non Persoon (1798); en outre, il représente *H. truncatum* sensu Lange (1938), non Fries (1821), dont malheureusement, à l'herbier de Copenhague (C), on ne trouve pas trace du matériel original recueilli par J. E. Lange (H. Knudsen in litt.).

Il faut noter en outre que le basionyme *Agaricus truncatus* Schaeff. (Fung. Bav. IV: 66, t.251, 1774) a été utilisé pour indiquer en même temps deux espèces appartenant à deux genres différents: *Rhodocybe truncata* (Schaeff. : Fr.) Singer (1946) et *Hebeloma truncatum* (Schaeff. : Fr.) Kummer (1871). Du moment que nous-même, comme du reste la plupart des Auteurs, parmi lesquels récemment Baroni (1981), retenons que l'interprétation de *Agaricus truncatus* Schaeff. (op. cit.), comme celles de Fries (1821), Britzelmayr (1879), Cooke (1881) et Quélet (1886), est à associer effectivement à *Rhodocybe truncata*, nous avons jugé opportun de décrire le champignon de Ricken et de Lange comme une espèce nouvelle, en lui assignant l'épithète de "*theobrominum*", de *Theobroma cacao* L., pour la couleur de son chapeau.

H. theobrominum correspond fort bien à l'interprétation donnée, comme *H. truncatum*, par les Auteurs modernes, tels Kühner et Romagnesi (1953), Favre (1960), Bruchet (1970), Moser (1983), alors qu'il ne correspond pas du tout à l'interprétation de Bon et Chevassut (1974), surtout pour les spores: "...assez nettement verruqueuse, à épispore décollée...".

A la suite de notre travail de subdivision du genre *Hebeloma* sect. *Denudata* (Fr.) Sacc. (Quadraccia, 1984, sorti de presse en 1985), nous considérons que H. theobrominum, à cause de sa cortine non perceptible même sur les sujets immatures, de ses lamelles parfois sub-larmoyantes des gouttelettes aqueuses (bien que jamais tachées par les spores), de ses cellules marginales sub-cylindriques ou clavato-capitulées et de ses spores lisses ou finement ponctuées, n'est pas à placer dans la subsect. Sinapizantia Quad., comme cela a été fait jusqu'à présent par les Auteurs qui ont utilisé l'épithète "truncatum", mais bien dans la subsect. Hiemalia Quad..

REMERCIEMENTS

Nous remercions vivement le Dr. V. Demoulin (Liège) et le Professeur A. Rambelli (Rome), pour leurs précieuses suggestions ou corrections.

Nous désirons également remercier les Directeurs et Curateurs des herbiers, pour le matériel qu'ils nous ont aimablement prêté et en particulier: le Dr. C. Bas, du Rijksherbarium (Leyde); le Dr. L. Granel de Solignac, de l'Institute Botanique de Montpellier; le Dr. H. Knudsen, du Botanisk Museum (Copenhague); le Dr. G. Lucchini, du Museo Cantonale di Storia Natuale (Lugano); ainsi que MM. R. Dell'Orbo (Rome), P. Escallon (Thonon-les-Bains), F. Gröger (Warza), F. Marti (Peseux) et le Professeur S. Onofri (Rome), pour leur amicale collaboration.

BIBLIOGRAPHIE

BARONI, T. J., 1981. A revision of the genus Rhodocybe Maire (Agaricales). Beih., Nova Hedwigia 67: 1-194.

BON, M. & CHEVASSUT, G., 1974. Agaricales de la région "Languedoc-Cevennes" (3ème partie). Doc. mycol. 4(15): 1-35.

BRESADOLA, G., 1930. Iconographia Mycologica XV. Ed. Mediolani, Milano.

BRITZELMAYR, M., 1879. Die Hymenomyceten Augsburgs und seiner Umgebung. Augsburg.

BRITZELMAYR, M., 1894. Hymenomyceten aus Südbayern X. Berlin.

BRUCHET, G., 1970. Contribution à l'étude du genre Hebeloma (Fr.) Kummer; partie spéciale. Bull. mens. Soc. Linn. Lyon, suppl. au 39(6): 1-132.

CETTO, B., 1983. I funghi dal vero, vol. 4°. Ed. Saturnia, Trento.

COOKE, M. C., 1881. Illustrations of British Fungi I. London.

FAVRE, J., 1960. Catalogue descriptif des champignons supérieurs de la zone subalpine du Parc National suisse. Liestal.

FRIES, E. M., 1821. Systema mycologicum I. Lundae.

FRIES, E. M., 1830. Agaricos synonymos in Persoonii Mycologia Europaea III et Systemate suo mycologico reconciliat. Linnaea 5: 689-731.

FRIES, E. M., 1877. Icones selectae Hymenomycetum II. Stockholm.

GRÖGER, F. & ZSCHIESCHANG, G., 1981. Hebeloma-Arten mit sacchariolens-Geruch. Z. Mykol. 47(2): 195-210.

HIRSCH, G., 1984. Pilzflora der DDR. Zur Nomenklatur einiger Taxa. Wiss.

Ztschr. Friedrich-Schiller-Univ. Jena, Naturwiss. Reihe 33(6): 813-820.

KONRAD, P. & MAUBLANC, A., 1924-1937. Icones selectae Fungorum I-IV. Paris.

KÜHNER, R. & ROMAGNESI, H., 1953. Flore analytique des champignons supérieurs. Ed. Masson, Paris.

KUMMER, P., 1871. Der Führer in die Pilzkunde. Zerbst.

LANGE, J. E., 1938. Flora Agaricina Danica III. Copenhagen.

MAIRE, R., 1914. La flore mycologique des forêts Cèdres de l'Atlas. Bull. Soc. Mycol. Fr. 30: 199-220.

MALENÇON, G. & BERTAULT, R., 1970. Flore des champignons supérieurs du Maroc I. Rabat.

MICHAEL, E. & HENNIG, B., 1967. Handbuch für Pilzfreunde IV. Verl. Fischer, Jena.

MOSER, M., 1970. Beiträge zur Kenntnis der Gattung Hebeloma. Zeitschr. f. Pilzk. 36(1+2): 61-75.

MOSER, M., 1983. Die Röhrlinge und Blätterpilze. Basidiomyceten II, Kleine Kryptogamenflora 2b/2. 5 Aufl. Stuttgart.

PERSOON, C. H., 1798-1800. Icones et Descriptiones Fungorum minus cognitorum. Lipsiae.

PERSOON, C. H., 1801. Synopsis methodica fungorum. Göttingen.

QUADRACCIA, L., 1984. Combinaisons et taxons nouveaux (Basidiomycetes). Doc. mycol. 14(56): 27-32.

QUELET, L., 1879. Champignons récemment observés en Normandie. Bull. Amis Sc. Nat. Rouen, t. I, f. 2.

QUELET, L., 1886. Enchiridion fungorum in Europa media et praesertim in Gallia viventium. Lutetiae.

QUELET, L., 1888. Flore mycologique de la France et des Pays limitrophes. Paris.

RICKEN, A., 1915. Die Blätterpilze. Verl. Weigel, Leipzig.

ROMAGNESI, H., 1983. Etudes sur le genre Hebeloma. II. Sydowia 36: 255-268.

ROMAGNESI, H., 1985. Novum nomen. Novitates. Doc. mycol. 15(59): 53.

SACCARDO, P. A., 1887. Sylloge Fungorum V. Padova.

SACCARDO, P. A., 1916. Flora Italica Cryptogama. Hymeniales II. Rocca S. Casciano.

SCHAEFFER, J. C., 1774. Fungorum qui in Bavaria et Palatinatu circa Ratisbonam nascuntur IV. Regensburg.

SMITH, A. H., EVENSON, V. S. & MITCHEL, D. H., 1983. The veiled species of Hebeloma in the western United States. The University of Michigan Press. Ann Arbor.

SINGER, R., 1946. Two new species in the Agaricales. Mycologia 38: 687-690.

SINGER, R., 1961. Type studies on Basidiomycetes. X. Persoonia 2(1): 1-62.

VELENOVSKY, J., 1920. České houby II. Praha.

VESTERHOLT, J. & WEHOLT, Ø., 1985. Hebeloma sect. Hebeloma in Scandinavia. Agarica 6(12): 158-177.

MYCOTAXON

Vol. XXX, pp. 319-334 October-December 1987

NEW OR INTERESTING SPECIES OF *XANTHOPARMELIA* (VAINIO) HALE (ASCOMYCOTINA: PARMELIACEAE)*

Mason E. Hale

Department of Botany, Smithsonian Institution
Washington, DC 20560, U.S.A.

Abstract: The following 22 new species of *Xanthoparmelia* are described: *X. affinis* Hale, *X. applicata* Hale, *X. austrocapensis* Hale, *X. durietzii* Hale, *X. mbabanensis* Hale, *X. microlobulata* Hale, *X. naudesnekia* Hale, *X. neochlorochroa* Hale, *X. neotumidosa* Hale, *X. norchlorochroa* Hale, *X. norhypopsila* Hale, *X. obscurata* Hale, *X. pseudocongensis* Hale, *X. psoromica* Hale, *X. putsoa* Hale, *X. rugulosa* Hale, *X. subdiffluens* Hale, *X. subplittii* Hale, *X. subsorediata* Hale, *X. tenacea* Knox and Hale, *X. tenuiloba* Hale and *X. tolucensis* Hale. Further data are given on the chemistry of *X. competita* Hale and *X. duplicata* Hale. These new combinations are made: *X. neopropagulifera* (Gyelnik) Hale, *X. stenophylloides* (Vainio) Hale and *X. xanthomelaena* (Müll. Arg.) Hale.

Xanthoparmelia affinis Hale, sp. nov. Fig. 1

Thallus laxe adnatus, saxicola, pulvinatus, 4–6 cm diametro, obscure viridi-flavicans, lobis sublinearibus, 0.5–1 mm latis, separatis, elongatis, plus minusve constrictis, superne continuus vel leviter maculatus, nitidus, isidiis sorediisque destitutus, subtus planus, pallide brunneus, modice rhizinosus.

Thallus loosely adnate on rocks, somewhat pulvinate and easily breaking apart, 4–6 cm broad, darkish yellow-green; lobes sublinear, 0.5–1 mm wide, elongate but somewhat constricted, separate to imbricate; upper surface faintly to partly distinctly white maculate, shiny, isidia and soredia lacking; medulla white; lower surface plane to barely convoluted, pale brown to brown, shiny, moderately rhizinate, the rhizines brown or blackening, simple to furcate, 0.2-0.6 mm long. Pycnidia poorly developed; conidia not found. Apothecia lacking.

Chemistry: Salazinic and usnic acids.

Type collection: On sandstone in open ridges in karoo, Franschoek Pass on hwy R45, elev. 650 m, Cape Province, South Africa, Grid 3318 CC, *Hale* 78184, 26 Oct. 1986 (US, isotype; LD, PRE, isotypes).

This species is superficially close to the more common *X. constrictans* (Nyl.) Hale, which has a jet black lower surface.

---

*Field studies supported by a grant from the Smithsonian Scholarly Studies Program. I am indebted to Dr. J. A. Elix and Jen Johnston for chemical determinations.

Xanthoparmelia applicata Hale, sp nov. Fig. 2

Thallus arcte adnatus vel subcrustosus, saxicola, 4–8 cm latus, lobis subirregularibus, contiguis, 1–2 mm latis, superne continuus, aetate transversim fissus, isidiis sorediisque destitutus, subtus planus, modice rhizinosus.

Thallus tightly adnate on rock, the center appearing areolate, 4–8 cm broad, light yellowish green; lobes sublinear, 1–2 mm wide, contiguous, crowded at the center; upper surface continuous, shiny, emaculate, transversely cracked with age, isidia and soredia absent; lower surface plane, pale brown, moderately rhizinate, the rhizines pale brown, simple, 0.2–0.4 mm long. Pycnidia abundant; conidia bifusiform, 5–6 μm long. Apothecia abundantly developed, adnate, 1–4 mm in diameter, the disc plane; hymenium 40–42 μm; spores 6 × 9–10 μm.

Chemistry: barbatic, 4-O-demethylbarbatic (major), diffractaic (trace), squamatic (trace), 3-α-hydroxybarbatic (faint trace), baeomycesic (faint trace) and usnic acids (det. J. A. Elix).

Type collection: On low outcrops in karoo, 12 km N of Jansenville, elev. 600 m, Cape Province, S. Africa, Grid 3224 DB, *Hale* 77664, 18 Oct. 1986 77664 (US, holotype; PRE, isotype).

Additional specimens examined. S. Africa. Cape Province: Mountain Zebra National Park, SE of Cradock, Grid 3225 AB, *Hale* 77268, 77299 (US); 26 km S of Strydenburg, Grid 3023 BB, *Hale* 78731 (US). Orange Free State: Orange River crossing on Hwy R48, N of Koffiefontein, Grid 2924 AC, *Hale* 78880 (US).

This karoo lichen has probably been misidentified previously as *X. brunnthaleri* (Stein. & Zahlbr.) Hale, a smaller, more tightly adnate species with scabrosin derivatives as the major component. *Xanthoparmelia worcesteri* (Stein. & Zahlbr.) Hale is also close but contains lecanoric acid.

Xanthoparmelia austrocapensis Hale, sp. nov. Fig. 3

Thallus laxe adnatus, terricola vel saxicola, 6–12 cm latus, plus minusve pulvinatus, lobis sublinearibus, 0.6–1 mm latis, elongatis, apice lobato-laciniatis, superne continuus, isidiis sorediisque destitutus, subtus planus vel vix convolutus, niger, modice rhizinosus.

Thallus loosely adnate on soil or rarely on rock, 6–12 cm broad, often pulvinate, light yellowish green; lobes sublinear, 0.6–1 mm wide, elongate and dichotomously branched, divaricately imbricate, lobate-laciniate at the tips, the laciniae about 0.3 mm wide; upper surface continuous, shiny at the tips but turning dull and rugose toward the center, isidia and soredia lacking; lower surface plane to very weakly convoluted, black, sparsely to moderately rhizinate, the rhizines rather coarse, sparsely furcate, 0.3–1.2 mm long. Pycnidia common; conidia bifusiform, 0.5 × 5–6 μm. Apothecia rarely developed, substipitate, 5–10 mm in diameter; spores usually poorly developed, 5 × 9 μm.

Chemistry: stictic, constictic, norstictic, and usnic acids.

Type collection: Plat Klip, near Stellenbosch, South Africa, Grid 3318 DD, *Garside* s.n., 15 July 1942 (BOL, holotype; US, isotype).

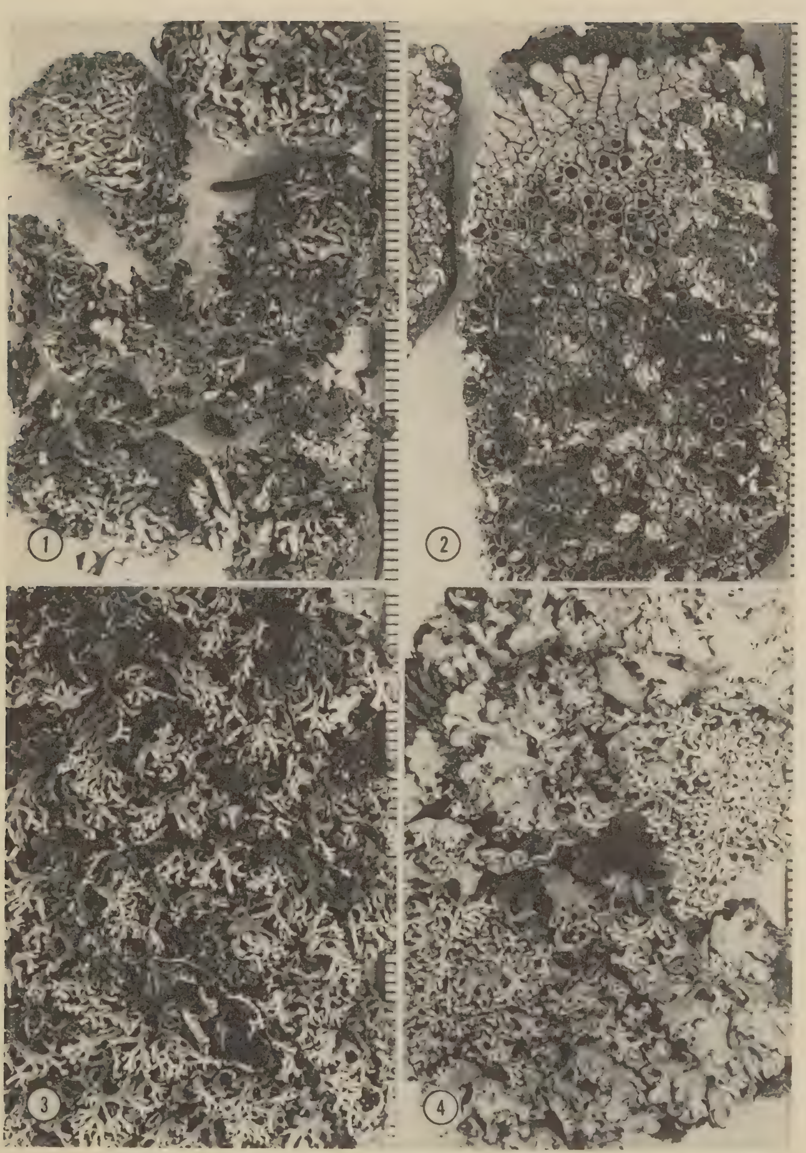
Additional specimens examined. S. Africa. Cape Province: Same locality as the holotype, *Almborn* 5267, 5272 (LD, US), *Garside* 5037, 5094, 5096 (BOL, US); 28.3 km ENE of Touwsrivier, Grid 3320 AC, *Hale* 78438 78447, 78451 (US); 29.7 km ENE of Clanwilliam, Grid 3219 AA, *Hale* 72231 (US); 3.5 km NW of Cederberg, Grid 3219 AC, *Hale* 78771 (US); Pakhuis Pass, ENE of Clanwilliam, Grid 3218 BB, *Hale* 72229 (US).

Of the related loosely adnate species with stictic acid, South African *X. simulans* Hale has sublinear, irregularly constricted, strongly black-rimmed lobes and *X. austroamericana* Hale from southern South America has broader lobes (1–2.5 mm wide) and very sparse rhizines.

Xanthoparmelia competita Hale, Mycotaxon 27:568. 1986.

Parmelia eximia Brusse, Mycotaxon 27:183. 1986. Type collection: 65 km WNW of Willowmore, Cape Province, South Africa, *Brusse* 4840 (PRE, holotype; US, isotype).

Dr. J. A. Elix redetermined the previously unknown chemistry of this rare karoo lichen as 4-O-methylhypoprotocetraric acid (major), hypoprotocetraric acid (minor) and an unknown at Rfc 30 (major) (type of *X. competita*). The type specimens of *X. competita* and *P. eximia* have identical chemistry and are otherwise the same morphologically except for a greater degree of rugosity in *P. eximia*.



Figures 1–4. Holotypes of *Xanthoparmelia*: 1, *X. affinis*; 2, *X. applicata*; 3, *X. austrocapensis*; 4, *X. durietzii*. Scale in mm.

Xanthoparmelia duplicata Hale, Mycotaxon 27:572. 1986.

An unknown substance previously reported in this species has now been determined as a new acid, 4-O-demethyldiffractaic acid, by Dr. J. A. Elix. A second report of this acid is given below under *X. neotumidosa*.

Xanthoparmelia durietzii Hale, sp. nov. Fig. 4

Thallus laxe adnatus, terricola, 6–8 cm latus, lobis sublinearibus, centrum versus dense laciniatis, laciniis digitato-divisis, superne maculatus, isidiis sorediisque destitutus, subtus planus, brunneus, modice rhizinosus.

Thallus loosely adnate on soil or mossy humus, 6–8 cm broad but breaking apart and brittle when collected, dull yellowish green; lobes sublinear, 1.5–3 mm wide, relatively short and irregularly dichotomously branched, contiguous to imbricate, becoming apically laciniate with age toward the center, the laciniae 0.3–0.5 mm wide, digitately branching, appressed to suberect and terete at maturity; upper surface white maculate, shiny, isidia and soredia lacking; lower surface plane, light brown to brown, moderately to densely rhizinate, the rhizines brown, simple, 0.5–1 mm long. Pycnidia common; conidia bifusiform, 5–6 μm long. Apothecia lacking.

Chemistry: Salazinic and usnic acids.

Type collection: Kansu, China, *Potanin* s.n., 10 April 1885 (UPS, holotype; US, isotype).

Additional specimen examined. China. Prov. Chili: Hsiao-wu-tai-shan, *Smith* 5304 (UPS).

This member of the *X. somloensis* ("stenophylla") group is distinguished by the well developed terete laciniae. Known only from China, it was identified by Du Rietz as "Parmelia potaninii."

Xanthoparmelia mbabanensis Hale, sp. nov. Fig. 5

Thallus adnatus, saxicola, 5–8 cm latus, lobes subirregularibus, 2–3 mm latis, superne continuus, modice isidiatus, isidiis cylindricis, subtus planus, niger, sparse rhizinosus.

Thallus adnate to loosely adnate on rock, rather brittle and falling apart when collected, 5–8 cm broad, darkish yellow green; lobes subirregular to sublinear, 2–3 mm wide, imbricate; upper surface continuous, shiny, moderately isidiate, the isidia cylindrical, 0.08–0.1 mm in diameter, to 0.3 mm high, simple to sparingly branched; lower surface plane, dark brown toward the tips but blackening at the center, sparsely rhizinate, the rhizines brown to black, stout, simple, 0.3–0.5 mm long. Pycnidia not common; conidia bifusiform, 0.5 × 5–6 μm. Apothecia common, substipitate, 2–4 mm in diameter; spores 5–6 × 8–9 μm.

Chemistry: fumarprotocetraric, succinprotocetraric, physodalic and usnic acids.

Type collection: Mbabane Nature Reserve, 10 km N of Mbabane, elev. 1000 m, Swaziland, Grid 2631 AA, *Hale* 79071 (US, holotype; LD, PRE, isotypes).

Additional specimens examined. Swaziland. Same locality as the holotype, *Hale* 79036 (US). South Africa. Natal: W of Ubombo, Ubombo Mountains, Grid 2732 CA, *Hale* 78929, 78933, 78990 (US).

Closely related to *X. subramigera* (Gyelnik) Hale, which occurs commonly with it, *X. mbabanensis* has a distinctly black lower surface.

Xanthoparmelia microlobulata Hale, sp. nov. Fig. 6

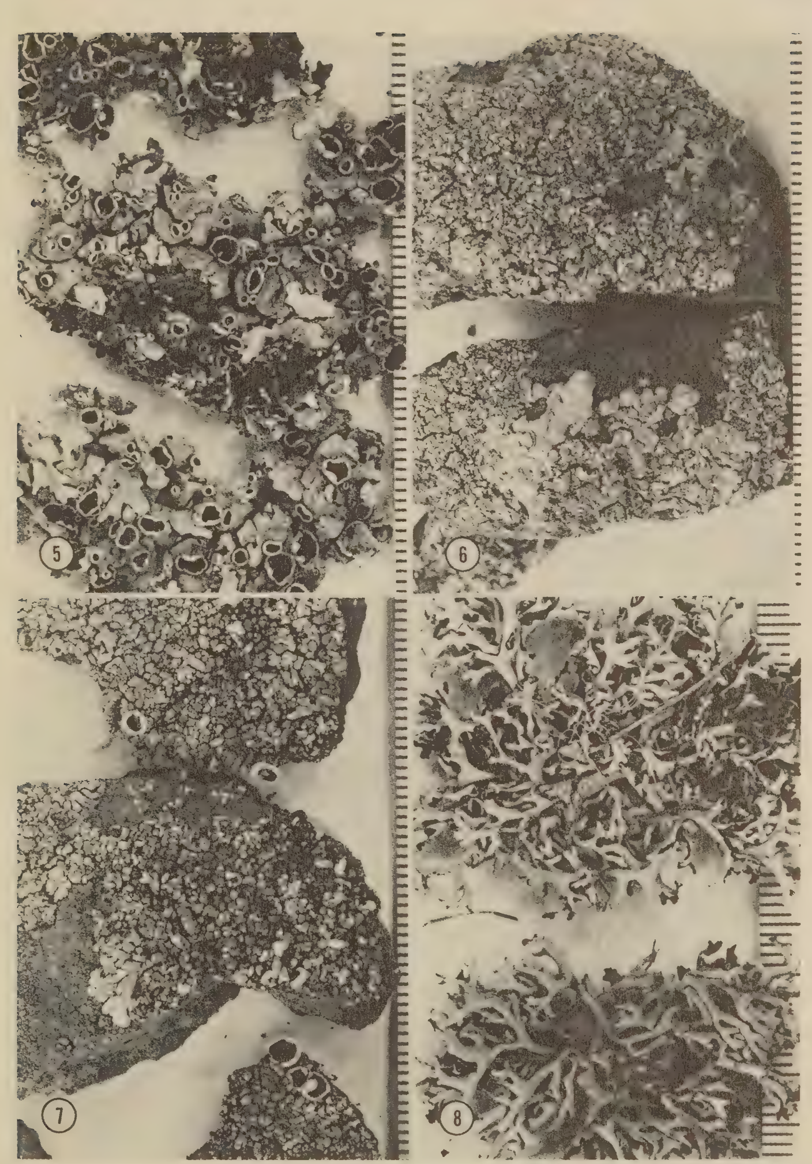
Thallus adnatus, saxicola, 5–8 cm latus, lobis subirregularibus, 1.5–3 mm latis, dense lobulatis, superne emaculatus, isidiis sorediisque destitutus, subtus planus, pallide brunneus, sparse rhizinosus.

Thallus adnate to tightly adnate on rock, rather fragile, 5–8 cm broad, dull yellowish green; lobes subirregular, 1.5–3 mm wide, contiguous to imbricate, becoming densely lobulate, the lobules 0.1–0.5 mm wide, to 0.5 mm long, appressed and imbricated; upper surface continuous, shiny, emaculate; isidia and soredia lacking; lower surface plane, pale brown, sparsely to moderately rhizinate, the rhizines pale brown, 0.2–0.3 mm long but barely papillate at the lobe tips. Pycnidia well developed; conidia weakly bifusiform, 5–6 μm. Apothecia lacking.

Chemistry: Norlobaridone, isonorlobariol, unknown fatty acid and usnic acid (det. J. A. Elix).

Type collection: On basaltic outcrops at the escarpment, Naudesnek, elev. 2180 m, Cape Province, S. Africa, Grid 3028 CB, *Hale* 76859, 9 Oct. 1986 (US, holotype; ANUC, PRE, isotypes).

This high elevation species is distinguished by its chemistry, norlobaridone being extremely rare in



Figures 5–8. Holotype of *Xanthoparmelia*: 5, *X. mbabanensis*; 6, *X. microlobulata*; 7, *X. naudesnekia*; 8, *X. neochlorochroa*. Scale in mm.

South African *Xanthoparmeliae*, and by the abundant production of marginal lobules.

Xanthoparmelia naudesnekia Hale, sp. nov. Fig. 7

Thallus arcte adnatus, saxicola, 5–7 cm latus, lobis subirregularibus, 1–2 mm latis, dense lobulatis, superne emaculatus, isidiis sorediisque destitutus, subtus planus, brunneus, modice rhizinosus.

Thallus tightly adnate to adnate on rock, firm, 5–7 cm broad, dull yellowish green; lobes subirregular, 1–2 mm wide, black rimmed, contiguous to imbricate but soon densely lobulate, the lobules sublaciniate and appressed, 0.5–1 mm wide and 1–2 mm long; upper surface continuous, shiny, emaculate, heavily pycnidiate, isidia and soredia lacking; medulla ochre in lower part; lower surface plane, light brown to brown, moderately rhizinate, the rhizines simple, pale brown, 0.2–0.4 mm long. Pycnidia not seen. Apothecia substipitate, 3–5 mm in diameter; spores not found.

Chemistry: Hypostictic (major), stenosporonic (major), colensoic (minor), hyposalazinic (minor), hypoconstictic (trace) and usnic acids, unknown PQ-4 and skyrin (det. J. A. Elix).

Type collection: On sheltered basaltic rocks in escarpment, Naudesnek, elev. 2180 m, Cape Province, S. Africa, Grid 3028 CB, *Hale* 76868, 9 Oct. 1986 (US, holotype; PRE, isotype).

A very similar species from Naudesnek, *X. brevilobata* Hale (Mycotaxon 28:252. 1987), lacks stenosporonic acid.

Xanthoparmelia neochlorochroa Hale, sp. nov. Fig. 8

Thallus vagans, terricola, 2–4 cm latus, lobis sublinearibus, 1–2 mm latis, superne continuus, isidiis sorediisque destitutus, subtus valde convolutus, dense rhizinosus.

Thallus vagrant, free growing on soil, firm, breaking up into discrete colonies 2–4 cm broad, light yellowish green; lobes sublinear, 1–2 mm wide, irregularly branched, separate to imbricate; upper surface continuous to very faintly maculate, shiny, rugulose with age, isidia and soredia lacking; lower surface strongly convoluted with an inconspicuous rim near the tips, brown, shiny, moderately to densely rhizinate, the rhizines brown with whitish splayed tips, 0.3–0.6 mm long. Pycnidia and apothecia lacking.

Chemistry: Norstictic and usnic acids.

Type collection: 27 mi S of Salmon, Lemhi County, Idaho, *Anderegg* 1480, 18 June 1973 (US, holotype; ASU, isotype).

Additional specimens examined. U.S.A. Idaho. Custer County: 20 mi S of Challis, *Anderegg* 1475; Sect. 30, T12N, R18E, *Anderegg* 1161 (US); Owyhee County: Upper Succor Creek, *Rosentreter* 1086 (US, Rosentreter herb.). Wyoming. Carbon County: 1 mi N of Bairoil, *Hubricht* B1304 (US).

This is essentially the norstictic acid-containing chemotype of *X. chlorochroa* (Tuck.) Hale, a widespread vagrant soil lichen in western North America. It parallels *X. norconvoluta-X. convoluta* in Australia (Elix, Johnston & Armstrong, Bull. Brit. Mus. (Nat. Hist.), 15:163-362. 1986).

Xanthoparmelia neopropagulifera (Gyelnik) Hale, comb. nov. Fig. 9

Parmelia stenophylloides var. *propagulifera* Vainio, Acta Soc. Fauna Fl. Fenn. 7(7):62. Type collection: Caraça, Minas Gerais, Brazil, *Vainio, Lich. Bras. Exs.* 1241b (TUR, lectotype).

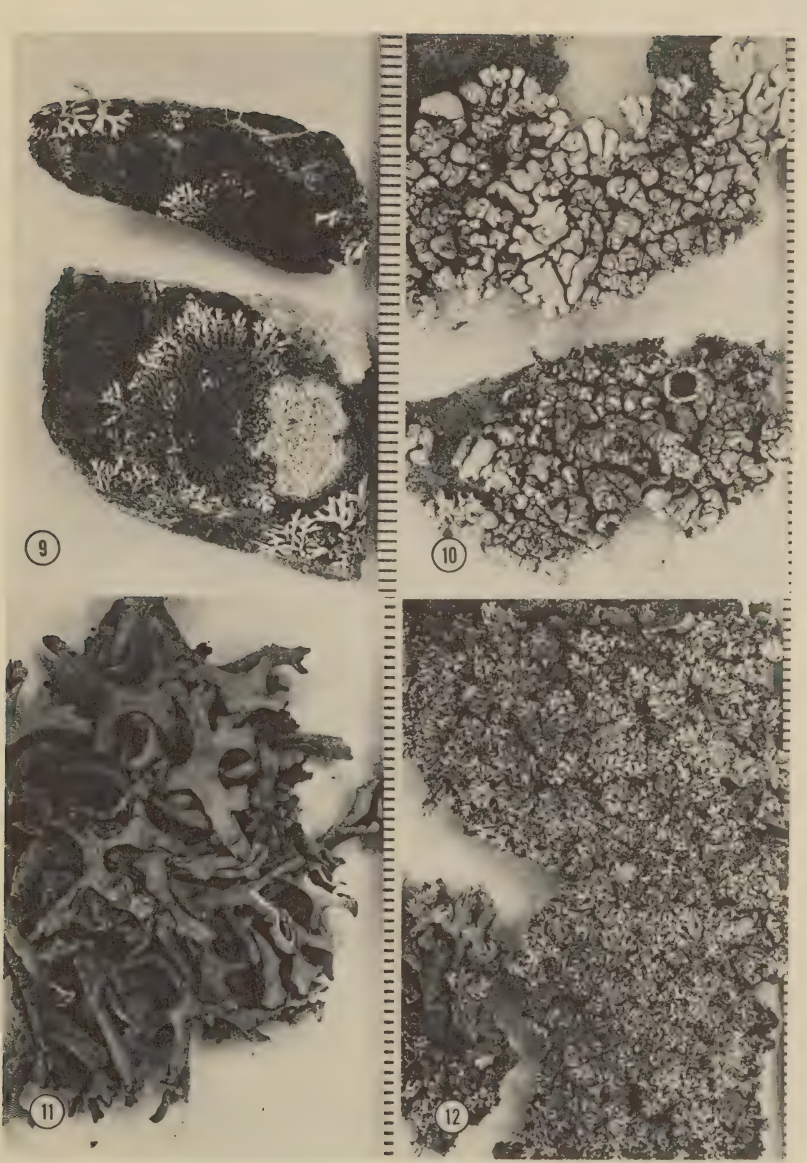
Parmelia propagulifera (Vainio) Gyelnik, Ann. Hist.-Nat. Mus. Nat. Hung. 31:39. 1938. Not *P. propagulifera* Vainio ex anno 1889 (=*Everniastrum*).

Parmelia neopropagulifera Gyelnik, Ann. Hist.-Nat. Mus. Nat. Hung. 31:39. 1938. Based on *P. stenophylloides* var. *propagulifera* Vainio.

Thallus tightly adnate on rock, the center sometimes decaying with new colonies invading to form a centrifugate growth pattern, 4–6 cm broad, light yellowish green but darkening with age; lobes sublinear, 0.3–1 mm wide, elongate and dichotomously branched, separate to contiguous; upper surface continuous, shiny, transversely cracked with age, moderately isidiate, the isidia cylindrical, 0.05–0.07 mm in diameter, 0.1–0.15 mm high; lower surface plane, brown, shiny, moderately rhizinate, the rhizines stout, unbranched, 0.1–0.2 mm long. Pycnidia and apothecia lacking.

Chemistry: stictic, constictic, norstictic and usnic acids.

Specimens examined: Cuba. Isle of Pines: Las Tunas Mountains, *Britton* et al. 15519, Siguanea, *Britton* et al. 14393 (NY). Guatemala. Baja Vera Paz: Pachalum, *Hale* 38367 (US). Venezuela.



Figures 9 – 12. Holotypes of *Xanthoparmelia*: 9, *X. neopropagulifera*; 10, *X. neotumidosa*; 11, *X. norchlorochroa*; 12, *X. norhypopsila*. Scale in mm.

Estado Mérida: Cordillera de la Costa, Punta El Avila, *Oberwinkler & Poelt* s.n. (M, US). Ivory Coast. Cercle of Man: Mont Tonkoui, *Santesson* 10637a (UPS). Venda: Thathe Vanda, *Hale* 79153 (US). S. Africa. Natal: Umtamvuna Nature Reserve, *Hale* 76723 (US); Oribi Gorge, Grid 3030 CB, *Hale* 76741 (US). Australia. New South Wales: Echo Point, Blue Mountains, *Degelius* A-70 (UPS, US).

This widespread species is distinguished by the narrow, tightly adnate lobes, cylindrical isidia and the more or less consistently brown lower surface. The closest relative is *X. plittii* (Gyelnik) Hale, which is adnate and has broader lobes 1–2 mm wide with a pale brown lower surface.

Xanthoparmelia neotumidosa Hale, sp. nov. Fig. 10

Thallus adnatus, saxicola, 4–6 cm latus, lobis sublinearibus, convexis, 1–2 mm latis, superne continuus, isidiis sorediisque destitutus, subtus planus, pallide brunneus, modice rhizinosus.

Thallus adnate on rock, 4–6 cm broad, firm, light yellowish green; lobes sublinear, 1–2 mm wide, convex and appearing inflated, rather short and irregularly branched, contiguous to subimbricate; upper surface continuous, shiny, strongly rugose to almost bullate with age at the center, isidia and soredia lacking; lower surface plane, pale brown, moderately rhizinate, the rhizines pale brown, simple, 0.3–0.8 mm long. Pycnidia common; conidia bifusiform, 0.5 × 5–6 μm. Apothecia well developed, substipitate; spores 5 × 8–9 μm.

Chemistry: Protocetraric, 4-O-demethyldiffractaic and usnic acids.

Type collection: Douse-the-Glim Road, 3km NE junction with Hwy N7, N of Vanrhynsdorp, elev. 150 m, Cape Province, South Africa, Grid 3118 BC, *Hale* 78506 (US, holotype; PRE, isotype).

This is apparently a rare chemotype of *X. tumidosa* Hale, a common karoo lichen in Cape Province with protocetraric acid. Another species with this unusual chemistry is *X. duplicata* Hale (above), a loosely adnate, maculate lichen in the same region of Namaqualand.

Xanthoparmelia norchlorochroa Hale, sp. nov. Fig. 11

Thallus vagans, terricola, coriaceus, 5–10 cm latus, lobis sublinearibus, 2–7 mm latis, contortis, superne continuus vel maculatus, isidiis sorediisque destitutus, subtus valde convolutus, brunneus vel nigricans, rhizinis nullis.

Thallus vagrant, growing free on soil, firm and leathery, breaking up into irregular colonies 5–10 cm broad, dull yellowish green; lobes sublinear, 2–7 mm wide, elongated and contorted, sparsely branched, separate to imbricate; upper surface continuous to faintly white maculate, dull, rugose and reticulately cracked with age, isidia and soredia lacking; lower surface strongly convoluted, the lobes appearing tubular, exposed surface brown to black, smooth to strongly rugose, rhizines lacking. Pycnidia and apothecia lacking.

Chemistry: Norstictic and usnic acids.

Type collection: 4 mi S of Malta, Raft River Valley, Cassia County, Idaho, elev. 1300 m, *Holmgren* 173, 6 Aug. 1961 (US, holotype; ASU, isotypes).

Additional specimen examined. U.S.A. Idaho: 17 mi S of Challis, Custer County, *Anderegg* 1479 (US).

The large leathery thallus without rhizines and with a black lower surface is unique among the vagrant species. It has been found only in the desert grazing lands of Idaho, occurring with *X. chlorochroa*, a smaller plant with rhizines below.

Xanthoparmelia norhypopsila Hale, sp. nov. Fig. 12

Thallus adnatus, saxicola, 5–8 cm latus, lobis sublinearibus, 1–1.5 mm latis, centro dense lobulato-laciniatis, superne continuus, nitidus, dense isidiatus, isidiis cylindricis vel pro parte lobulatis decumbentibusque, subtus planus, niger, sparse rhizinosus.

Thallus adnate to loosely adnate on rock, 5–8 cm broad, dull yellowish green; lobes subirregular to sublinear, 1–1.5 mm wide, contiguous to imbricate, becoming densely lobulate-laciniate at the center, the laciniae dichotomously branched, 0.3–0.5 mm wide, appressed; upper surface continuous, shiny, densely isidiate, the isidia cylindrical and in part lobulate and decumbent, 0.15–0.2 mm in diameter, 0.1–0.3 mm high, unbranched; lower surface plane, shiny, dark brown at the tips and blackening at the center, sparsely rhizinate, rhizines black, simple, 0.2–0.4 mm long. Pycnidia well developed; conidia weakly bifusiform, 0.5 × 5–7 μm. Apothecia lacking.

Chemistry: Norstictic, connorstictic and usnic acids.

Type collection: Mill Bluff Roadside Park, Juneau County, Wisconsin, U.S.A., *Hale* 23106, July 1963 (US, holotype).

Additional specimen examined. Same locality as the holotype, *Hale* 23107 (US).

This rare species is unusual in having lobulate isidia and norstictic acid, a rare acid in North American lichens. It occurs mixed with *X. dierythra* (Hale) Hale, another isidiate, norstictic acid-containing lichen, differing in having cylindrical isidia and a pale brown lower surface.

Xanthoparmelia obscurata Hale, sp. nov. Fig. 13

Thallus adnatus, saxicola, fragilis, 5–8 cm latus, obscure flavidus, centrum versus nigricans, lobis sublinearibus, 0.3–1 mm latis, separatis vel imbricatis, apice subadscendentibus, superne continuus, opacus, isidiis sorediisque destitutus, subtus planus, pallide brunneus, modice rhizinosus.

Thallus closely adnate to adnate on rock, rather brittle and not easily removed, 5–8 cm broad, dull yellowish green at the tips but blackening at the center; lobes sublinear, 0.3–1 mm wide, irregularly branched, separate to imbricate but with ascending tips and becoming short laciniate; upper surface continuous, shiny at the tips but dull with age, isidia and soredia lacking; medulla white; lower surface plane, pale brown, moderately rhizinate, the rhizines brown, simple, 0.3–0.6 mm long. Pycnidia and apothecia lacking.

Chemistry: Norlobaridone, an unknown fatty acid and usnic acid (det. by J. A. Elix).

Type collection: On sloping sandstone outcrops, 3.5 km NW of Cederberg (Dwarsrivier), Cederberg Reserve, elev. 850 m, Cape Province, South Africa, Grid 3219 AC, *Hale* 78399, 29 Oct. 1986 (US, holotype; ANUC, PRE, isotypes).

This species, easily mistaken for a *Neofuscelia*, is extremely common at the type locality but has not been collected elsewhere. It is unlike any other African *Xanthoparmelia* and can only be compared with the Australian *X. dubitata* Elix & Johnston, which is very tightly adnate throughout with an areolate center.

Xanthoparmelia pseudocongensis Hale, sp. nov. Fig. 14

Thallus arcte adnatus, saxicola, 2–6 cm latus, lobis sublinearibus, 0.3–0.8 mm latis, nigromarginatis, superne continuus, modice isidiatus, subtus planus, niger, modice rhizinosus.

Thallus tightly adnate, 2–6 cm broad, light yellowish green or darkening; lobes sublinear, 0.3–0.8 mm wide, short dichotomously branched, contiguous to imbricate, black rimmed; upper surface continuous, shiny or becoming dull at the center, moderately isidiate, the isidia cylindrical, 0.06–0.09 mm in diameter, to 1 mm high, black tipped; lower surface plane, black, shiny, moderately rhizinate, the rhizines black, simple, 0.2–0.3 mm long. Pycnidia rarely developed; conidia 0.5 × 4–6 μm. Apothecia rare, adnate, 1–2 mm in diameter; spores 5–6 × 8–9 μm.

Chemistry: Stictic, constictic, and usnic acids.

Type collection: Road to Mangwazana Mission, Ubombo Mountains, N. of Ubombo, Natal, South Africa, Grid 2732 CA, *Hale* 78993, 8 Nov. 1986 (US, holotype; LD, PRE, isotypes).

Additional specimens examined. S. Africa. Cape Province: 7 mi E of George, Grid 2233 CC, *Almborn* 2347 (LD, US); 27.6 km NW of Elliott on Hwy R58, Grid 3127 BA, *Hale* 77084 (US); 21.6 km S of Tarkastad on Hwy R 344, Grid 3226 AB, *Hale* 77318 (US). Transvaal: Lejuma Summit, Soutpansberg Mountains, Grid 2329 AB, *Hale* 72233, 72234; Soutpansberg Trail near Mountain View Inn, Grid 2229 DD, *Hale* 76311, 76313 (US); Houbosorp, Magoebaskloof, Grid 2330 CC, *Hale* 74168 (US); Wonderview, Blyde River Nature Reserve, Grid 2430 DB, *Hale* 76099 (US); Mt. Sheba Nature Reserve, Grid 2430 DC, *Hale* 72232, 76111 (US); 32.6 kmm WNW of Pongola on Hwy R29, Grid 2731 AD, *Hale* 78955 (US). Natal: White Mfalozi River Gorge on Hwy R34, Grid 2831 AC, *Hale* 76397 (US); Ubombo Mountains, N of Ubumbo, Grid 2732 CA, *Hale* 78986 (US); Oribi Gorge Nature Reserve, Grid 3030 CB, *Hale* 75152 (US). Swaziland: Mbane Nature Reserve, N of Mbabane, Grid 2631 AA, *Hale* 79031 (US).

This common species, previously confused with *X. congensis* (Stein) Hale, has narrow but short and rather obtuse black-rimmed lobes and black-tipped isidia.

Xanthoparmelia psoromica Hale, sp. nov. Fig. 15

Thallus laxe adnatus, coriaceus, 7–12 cm latus, lobis subirregularibus, apice rotundatis, 3–7 mm latis, superne continuus, aetate rugulosus, isidiis sorediisque destitutus, medulla partim aurantiaca, subtus niger, modice rhizinosus.

Thallus adnate to loosely adnate on rock, firm, 7–12 cm broad, light yellowish green; lobes subirregular, 3–7 mm wide, apically rotund, contiguous to imbricate; upper surface continuous, dull, rugose with age, isidia and soredia lacking; medulla in part dull orange-red in the lower part; lower surface plane, dark brown at the tips, blackening at the center, rugulose with age, moderately rhizinate, the rhizines black, rather coarse, simple, 0.5–1 mm long. Pycnidia numerous; conidia bifusiform, 0.5 × 5–6 µm. Apothecia common, substipitate, 2–5 mm in diameter, the rim incurved; spores 6 × 9–11 µm.

Chemistry: Caperatic, psoromic and usnic acids, with or without the schenckiana pigment.

Type collection: 28.5 km N of Barkly Pass on Hwy R393, elev. 2200 m, Cape Province, South Africa, Grid 3127 BB, *Hale* 77030, 10 Oct. 1986 (US, holotype; LD, PRE, isotypes).

Additional specimens examined. South Africa. Cape Province: Same locality as the holotype, *Hale* 77035 (US); 17.6 km N of Barkly Pass on Hwy R393, Grid 3127 BB, *Hale* 77001, 77013, 77115 (US); 15.5 km W of Naudesnek on Hwy R396, Grid 3028 CC, *Hale* 77056 (US); 17.9 km N of Loxton on Hwy R63, Grid 3122 AD, *Hale* 78724 (US); 28.3 km E of Touwsrivier, Grid 3320 AC, *Hale* 78122 (US); 5.5 km NNW of Fraserburg on Hwy R353, Grid 3121 CD, *Hale* 78573 (US); 40 km E of Sutherland, Grid 3221 AC, *Brusse* 3371 (PRE); 78.6 km S of Sutherland on Hwy R354, Grid 3220 AC, *Hale* 73205 (US); 30 km SW of Middelpos, Grid 3220 AA, *Brusse* 3267 (PRE). Orange Free State: 1 km N of Koffiefontein on Hwy R48, Grid 2925 AC, *Hale* 78865 (US). Lesotho: Sani Pass, Grid 2929 CB, *Hale* 74167 (US).

This species is part of the *X. schenckiana-X. diacida complex*, lacking protocetraric acid. The American species *X. kurokawae* (Hale) Hale also contains psoromic acid but is a smaller lichen without any pigments.

Xanthoparmelia putsoa Hale, sp. nov. Fig. 16

Thallus adnatus, saxicola, coriaceus, 6–9 cm latus, viridi-flavicans, lobis subirregularibus, 2–3 mm latis, imbricatis, centro crasse laciniatis, laciniis 0.5–1 mm latis, adpressis, superne continuus, aetate rugulosus, isidiis sorediisque destitutus, subtus planus, pallide brunneus, modice rhizinosus.

Thallus adnate on rock, rather leathery, 6–9 cm broad, light yellowish green but darkening somewhat with age; lobes subirregular, 2–3 mm wide, contiguous to overlapping and becoming coarsely laciniate at the center, the laciniae sublinear, 0.5–1 mm wide, appressed, black-rimmed; upper surface continuous, shiny, rugulose with age, isidia and soredia lacking; medulla white; lower surface plane, pale brown, moderately rhizinate, the rhizines pale brown, simple 0.5–1 mm long. Pycnidia abundant; conidia bifusiform, 0.5 × 5–7 µm long. Apothecia poorly developed, substipitate, ca 1.5 mm in diameter; hymenium 40–45 µm; spores 5 × 7 µm, poorly developed.

Chemistry: Echinocarpic (major), gyrophoric (major), 5-O-methylhiascic (minor), conechinocarpic (minor) and usnic acids (Det. J. A. Elix).

Type collection: On low dolerite ledges on grassy bald, Blue Mountain Pass, elev. 2634 m, Lesotho, Grid 2928 BA, *Hale* 78977, 4 Nov. 1986 (US, holotype; ANUC, PRE, isotypes).

This is the first occurrence of echinocarpic acid in *Xanthoparmelia*. Morphologically the species is close to *X. gyrophorica* Hale (Mycotaxon 7:578. 1986), another high elevation species in Lesotho with a less congested, thinner, loosely adnate thallus and gyrophoric acid alone.

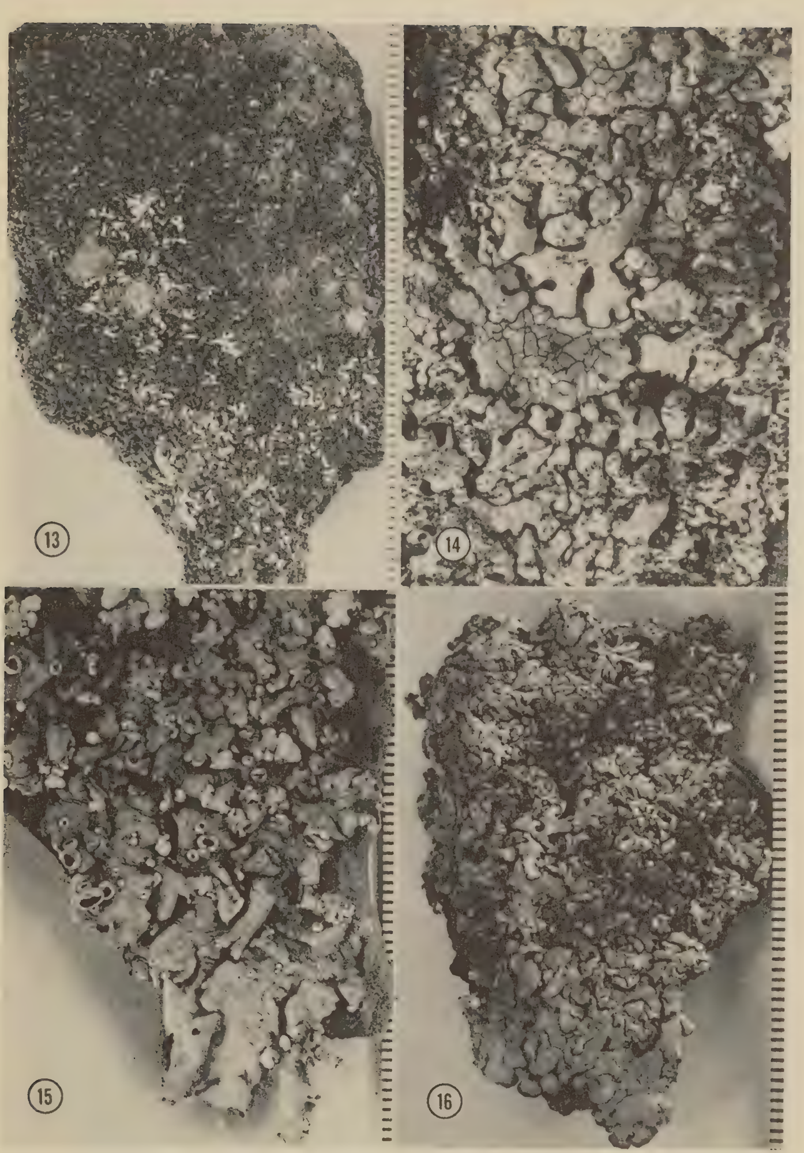
Xanthoparmelia rugulosa Hale, sp. nov. Fig. 17

Thallus arcte adnatus vel adnatus, saxicola, 3-5 cm latus, lobis subirregularibus, 1–1.5 mm latis, superne emaculatus, rugulosus aetate, isidiis sorediisque destitutus, subtus planus, pallide brunneus, modice rhizinosus.

Thallus tightly adnate to adnate on rock, fragile, 3–5 cm broad, yellowish green; lobes subirregular, 1–1.5 mm wide, short, contiguous to imbricate and crowded at the center; upper surface continuous, shiny, emaculate, rugulose with age; isidia and soredia lacking; lower surface plane, pale brown, moderately rhizinate, the rhizines pale brown, simple, 0.3–0.6 mm long. Pycnidia and apothecia lacking.

Chemistry: Barbatic, 4-O-demethylbarbatic and usnic acids (det. J. A. Elix).

Type collection: Large boulders on E-facing cave sandstone talus on a hillside pasture, 17.6 km NE of the town of Barkly Pass on the W side of hwy R393, elev. 1950 m, Cape Province, S. Africa,



Figures 13–16. Holotypes of *Xanthoparmelia*: 13, *X. obscurata*; 14, *X. pseudocongensis* (×10); 15, *X. psoromica*; 16, *X. putsoa*. Scale in mm.

Grid 3127 BB, *Hale* 76998, 10 Oct. 1986 (US, holotype; PRE, isotype).

The only other comparable species with barbatic acid is *X. tucsonensis* (Nash) Egan from western U.S.A., a much larger lichen with lobes 2–3 mm wide.

Xanthoparmelia stenophylloides (Mull. Arg.) Hale, comb. nov. Fig. 18

Parmelia adpressa var. *stenophylloides* Müll. Arg., Rev. Mycol. 10:56. 1888. Type collection: *Balansa* s.n., Paraguay (G, lectotype).

Parmelia stenophylloides (Müll. Arg.) Vainio, Acta Soc. Faun. Fl. Fenn. 7(7):62. 1890.

Description: Thallus tightly adnate on rock, 2–6 cm broad, light yellowish green but darkening at the center; lobes sublinear, 0.3–0.6 mm wide, elongate, dichotomously branched, separate to contiguous, laciniate marginally with age, the laciniae dichotomously branched, 0.2–0.4 mm wide; upper surface continuous, shiny, moderately isidiate, the isidia cylindrical, 0.06–0.09 mm in diameter, 0.1–0.2 mm high, unbranched; lower surface plane, dark brown at the tips but blackening at the center, shiny, moderately rhizinate, the rhizines black, simple, 0.1–0.2 mm long. Pycnidia rarely developed; conidia bifusiform, 0.5 × 5–6 µm. Apothecia lacking.

Chemistry: Stictic, constictic, norstictic and usnic acids.

Specimens examined. U.S.A. Louisiana: 3.5 mi NE of Hornbeck, Sabine County, *Hale* 34226 (US). Panama. Chiriqui Province: Llano del Volcán, *Scholander* s.n. (US). Venezuela. Estado Mérida: Mucuy, *Hale* 43039a (US). Brazil. Rio de Janeiro: Rio de Janeiro, *Glaziou* s.n. (G, US).

Gyelnik (Ann. Hist.-Nat. Mus. Nat. Hung. 29:20. 1935) despaired of understanding this species from Müller's fragmentary type. The type is probably isidiate and other specimens identified by Müller are so. It appears to be confined to the New World, perhaps related to *X. pseudocongensis* Hale but differing in having more delicate, elongate lobes without a black margin.

Xanthoparmelia subdiffluens Hale, sp. nov. Fig. 19

Parmelia conspersa var. *subdiffluens* Zahlbruckner in *Flora Hungarica Exsiccata* no. 619. 1925. Type collection: Near Tatárszentgyörgy, Pest, Hungary, *Boros* s.n., *Flora Hungarica Exsiccata* 619 (W, lectotype; H, UPS, US, isolectotypes). Nomen nudum.

Parmelia subdiffluens (Zahlbr.) Timkó in *Flora Hungarica Exsiccata*, no. 619. 1925. Nomen nudum.

Parmelia laxa var. *subdiffluens* (Zahlbruckner) Gyelnik, Fedde Repert. Sp. Reg. Veg. 36:158. 1934.

Parmelia laxa f. *parvula* Gyelnik, Fedde Repert Sp. Reg. Veg. 36:158. 1934. Type collection: Ágasegyházi forest, Izsák, Comit. Pest, Hungary, *Timkó* 4427 (BP, lectotype).

Parmelia conspersa f. *parvula* (Gyelnik) Gyelnik, Ann. Hist.-Nat. Mus. Nat. Hung. 30:124. 1936.

Thallus laxe adnatus vel vagans, terricola, 3–7 cm latus, lobis sublinearibus, 3–7 mm latis, separatis, superne albo-maculatus, isidiis sorediisque destitutus, subtus brunneus, modice rhizinosus.

Thallus loosely adnate to free growing on soil, 3–7 cm broad but breaking apart into separate lobes, darkish yellow green; lobes sublinear, 3–7 mm wide, strap-shaped and little branched, separate; upper surface finely white maculate, shiny, isidia and soredia lacking; lower surface plane, brown to dark brown, moderately rhizinate, the rhizines brown, simple, 0.5–1 mm long. Pycnidia and apothecia lacking.

Chemistry: Salazinic and usnic acids.

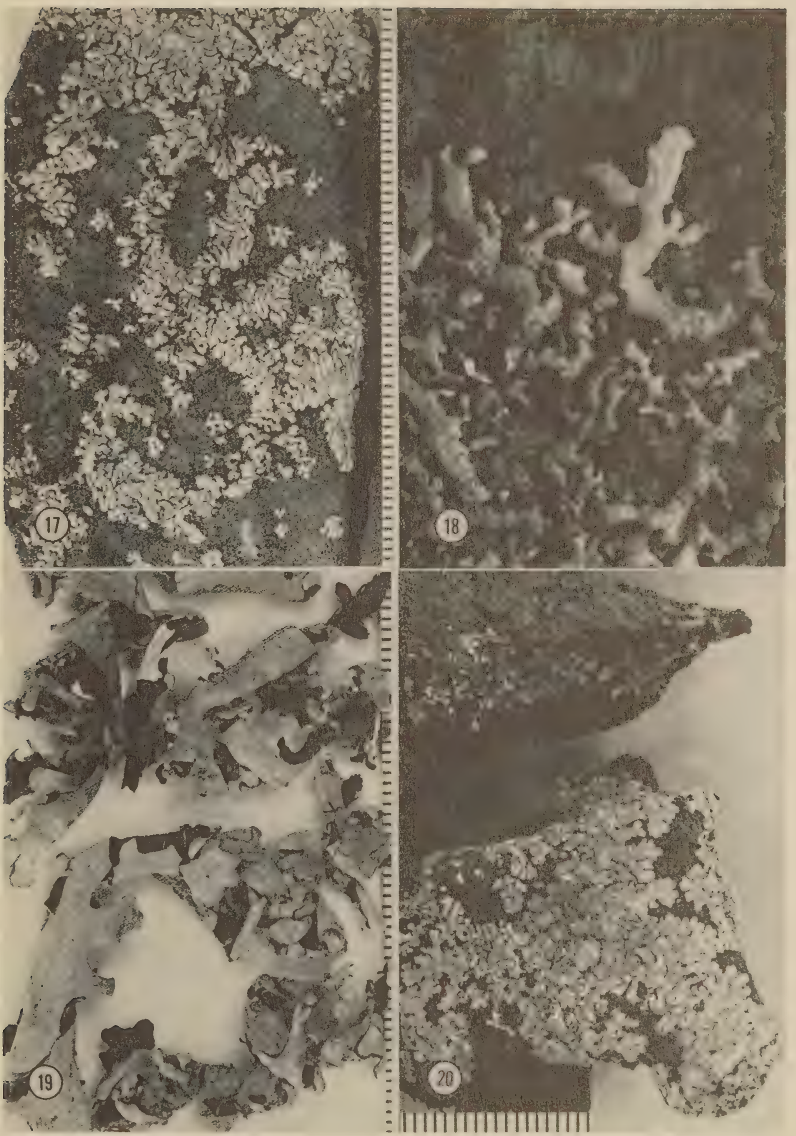
This terricolous lichen is rather common on arenaceous soils south of Budapest. It differs from *X. somloensis* (Gyelnik) Hale in the broader, flattened lobes and fragmented vagrant thallus.

Xanthoparmelia subplittii Hale, sp. nov. Fig. 20

Thallus adnatus, saxicola, 2–7 cm latus, lobis sublinearibus, brevibus, 1–1.5 mm latis, apice sparse lobulato-laciniatis, superne continuus, modice isidiatus, isidiis globosis, erumpentibus, subtus planus, pallide brunneus, modice rhizinosus.

Thallus tightly adnate to adnate on rock, rather fragile, 2–7 cm broad, light yellowish green; lobes subirregular to sublinear, 1–1.5 mm wide, dichotomously branched, sparsely lobulate-laciniate at the tips of older lobes, contiguous to imbricate; upper surface continuous, shiny, moderately isidiate, the isidia subcylindrical to globose and basally constricted, 0.1–0.2 mm in diameter, 0.1-0.2 mm high, unbranched, erumpent apically but not sorediate; lower surface plane, pale brown, moderately rhizinate, the rhizines pale brown, simple, 0.2–0.4 mm long. Pycnidia and apothecia lacking.

Chemistry: stictic, constictic, norstictic and usnic acids.



Figures 17-20. Holotype of *Xanthoparmelia*: 17, *X. rugulosa*; 18, *X. stenophylloides* (×10) (*Hale* 34226); 19, *X. subdiffluens*; 20, *X. subplittii*. Scale in mm.

Type collection: Arros Tobaty, Depto. Cordillera, Paraguay, *Schinini* 16262, April 1978 (US, holotype; CTES, isotype).

Additional specimens examined. Venezuela. Santa Ana, Peninsula de Paraguana, Estado Falcón, Venezuela, elev. 200–300 m, *López-Figueiras* 21360, 21834 (US, MERF); Islas Caracas, Parque Nacional Mochima, Estado Sucre, *Guariglia* 1836 (US).

This lowland tropical species is close to *X. plittii* (Gyelnik) Hale except for the globose, erumpent isidia.

Xanthoparmelia subsorediata Hale, sp. nov. Fig. 21

Thallus adnatus, saxicola, 5–8 cm latus, lobis sublinearibus, 1–2 mm latis, imbricatis, superne continuus, dense isidiatus, isidiis congestis, erumpentibus, subsorediatis, subtus planus, brunneus, modice rhizinosus.

Thallus adnate on rock, 5–8 cm broad; dark yellowish green; lobes sublinear, 1–2 mm wide, irregularly branched, crowded and imbricate; upper surface continuous, shiny at the tips, dull with age, densely isidiate, the isidia crowded, 0.08–0.15 mm in diameter, 0.1–0.3 mm high, mostly unbranched, soon covering most of the thallus surface, soon erumpent and becoming pustulate and subsorediate; lower surface plane, pale brown to brown, moderately rhizinate, the rhizines brown, simple, 0.3–0.6 mm long. Pycnidia and apothecia lacking.

Chemistry: stictic, constictic, norstictic and usnic acids.

Type collection: Páramo La Negra, Estado Mérida, Venezuela, elev. 3000 m, *López-Figueiras and Morales-Mendez* 29017, 25 March 1982 (US, holotype; MERF, isotype).

Additional specimens examined. Venezuela. Estado Mérida: Pico Águila, Sierra Nevada, *Hale* 44619a (US). Ecuador. Pichincha: Cerro Iliniza, *Arvidsson and Nilson* 919 (US, GB).

This high elevation species is very similar to *X. cordilleriana* (Gyelnik) Hale, an Andean species with salazinic acid.

Xanthoparmelia tenacea Knox and Hale, sp. nov. Fig. 22

Thallus arcte adnatus, saxicola, 2–4 cm latus, lobis subirregularibus, 0.7–1.7 mm latis, superne continuus, modice isidiatus, isidiis globosis, erumpentibus, subtus planus, brunneus, modice rhizinosus.

Thallus tightly adnate on rock, 2–4 cm broad, dull yellowish green; lobes subirregular, 0.7–1.5 mm wide, short, contiguous to imbricate; upper surface continuous, shiny, moderately isidiate, the isidia subcylindrical to mostly globose, 0.09–0.15 mm in diameter, 0.1–0 2 mm high, unbranched, erumpent and easily eroding but not sorediate; lower surface brown to dark brown, moderately rhizinate, the rhizines simple, 0.1–0.3 mm long. Pycnidia and apothecia lacking.

Chemistry: Salazinic, norstictic (trace) and usnic acids.

Type collection: Namib Kalunda Farm, escarpment slope of the highland, Namibia, *H. and E. Walter* 5131, 28 April 1975 (US, holotype; M, isotype).

Additional specimen examined. Namibia: Vicinity of the lower Swakop-Tales at Goanikontes, *H. & E. Walter* 5131 (M, US).

Externally similar to the Australian *X. praegnans* (Elix & Amrstr.) Elix & Johnst., this is a smaller lichen with a uniformly dark lower surface. It is known so far only in Namibia.

Xanthoparmelia tenuiloba Hale, sp. nov. Fig. 23

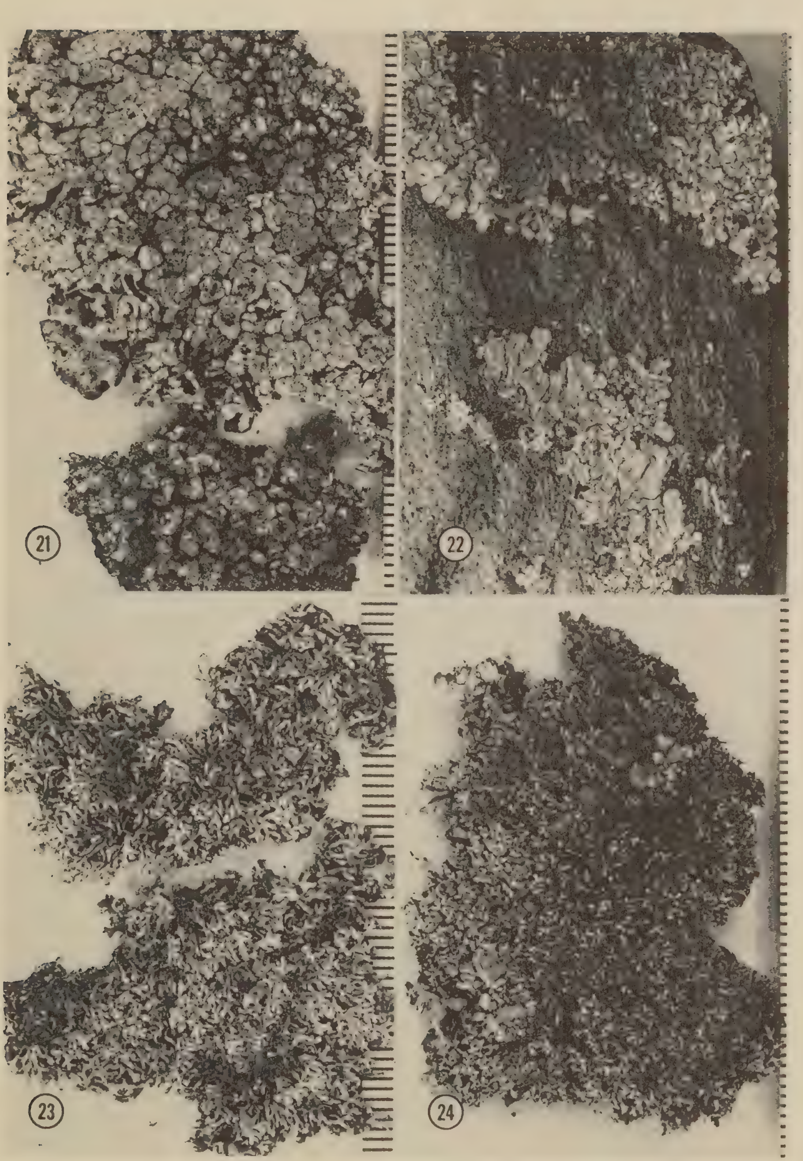
Thallus laxe adnatus, saxicola, 4–6 cm latus, lobis sublinearibus, 0.2–0.8 mm latis, imbricatis, superne emaculatus, isidiis sorediisque destitutus, subtus planus, pallide brunneus, sparse rhizinosus.

Thallus loosely adnate on rock, somewhat pulvinate, brittle, 4–6 cm broad, dark yellowish green; lobes sublinear, 0.2–0.8 mm wide, dichotomously branched, rather elongate and laciniate, imbricate; upper surface continuous, dull, isidia and soredia lacking; lower surface plane to barely canaliculate, pale brown, sparsely rhizinate, the rhizines pale brown, slender and simple to furcate, 0.5–1 mm long. Pycnidia common; conidia weakly bifusiform, 5–6 μm. Apothecia not seen.

Chemistry: Norlobaridone, an unknown substance and usnic acid (det. by J. A. Elix).

Type collection: On sheltered ledges, N side of Dutoits Pass on hwy N1, elev. 850 m, Cape Province, S. Africa, Grid 3319 CA, *Hale* 78259, 26 Oct. 1986 (US, holotype; ANUC, PRE, isotypes).

Xanthoparmelia metamorphosa (Gyelnik) Hale from Australia has a shiny, faintly maculate upper



Figures 21-24. Holotypes of *Xanthoparmelia*: 21, *X. subsorediata*; 22, *X. tenacea*; 23, *X. tenuiloba*; 24, *X. tolucensis*. Scale in mm.

surface, irregularly constricted, black-rimmed lobes, a nearly bare lower surface with short coarse rhizines, and a more loosely spreading thallus. This species is known so far only from the type locality, on windswept ledges exposed to mists of the prevailing strong SW winds.

Xanthoparmelia tolucensis Hale, sp. nov. Fig. 24

Thallus laxe adnatus, saxicola, fragilis, 6–8 cm latus, lobis sublinearibus, 1–2 mm latis, apice lobulato-dissectis, laciniis subteretibus, superne continuus, isidiis sorediisque destitutus, subtus planus, brunneus, modice rhizinosus.

Thallus adnate to loosely adnate on rock, rather brittle, 6–8 cm broad, darkish yellow green; lobes sublinear, 1–2 mm wide, crowded and imbricate, lobulate-dissected at tips and center of thallus, the lobulae becoming dense, suberect, digitate-terete, black tipped, 0.2–0.3 mm in diameter; upper surface continuous, shiny at the tips but dull with age, isidia and soredia lacking; lower surface plane, brown, moderately to densely rhizinate, the rhizines brown, simple, 0.3–0.6 mm long. Pycnidia and apothecia lacking.

Chemistry: stictic, constictic, norstictic, and usnic acids.

Type collection: Above crater lake at Volcán de Toluca, Estado México, Mexico, elev. 4160 m, *H. H. & C. M. Iltis* 3202 (US, holotype; WIS, isotype).

Additional specimen examined. Mexico. Estado México: East slope of Volcán de Toluca, elev. 4190 m, *H. H. & C. M. Iltis* 3094 (US, WIS).

This high elevation lichen is unique among the New World species in having terete lobules. Otherwise it is close to *X. cumberlandia* (Gyelnik) Hale.

Xanthoparmelia xanthomelaena (Müll. Arg.) Hale, comb. nov.

Parmelia xanthomelaena ("xanthomelana") Müll. Arg., Flora 66: 48. 1883. Type collection: Grampian Mountains, Australia, *Sullivan* 28 (G, lectotype).

Pseudoparmelia xanthomelaena (Müll. Arg.) Hale, Phytol. 29:191. 1974.

Thallus very tightly adnate to tightly adnate on rock, the central part appearing areolate, 4–5 cm broad, dull yellowish green or brownish and darkening with age at the center; lobes sublinear, 0.5–0.8 mm wide, contiguous to subimbricate, more or less black rimmed, sublaciniate with age; upper surface continuous, shiny, transversely cracked with age, isidia and soredia lacking; lower surface plane, black, moderately rhizinate, the rhizines, black, simple, 0.2–0.3 mm long. Pycnidia rare; conidia cylindrical to subbifusiform, 0.5 × 7–9 μm. Apothecia adnate, 0.5–1.5 mm in diameter; spores 6 × 10 μm.

Chemistry: Stictic, constictic, norstictic and usnic acids.

Representative specimens examined. Australia. New South Wales: Kiandra to Khancobar, *Hale* 66593 (US); Mt. Williams, Grampian Mountains, *Hale* 58346 (US). S. Africa. Cape Province: Fernkloof Nature Reserve, Grid 3419 AD, *Hale* 78176 (US); Outeniqua Pass, Grid 3322 CD, *Degelius* SA-138 (US).

On the basis of faulty microcrystal tests I had earlier assigned this species to *Pseudoparmelia* (Hale, Phytol. 29:191. 1974). Recent analyses with HPLC by Dr. J. A. Elix indicate the presence of usnic acid in the cortex. This species, known from Australia and South Africa, is apparently closely related to *X. tegata* Elix & Johnst., which is more loosely adnate.

MYCOTAXON

Vol. XXX, pp. 335-338 October-December 1987

A NEW SPECIES OF FLAVOPARMELIA AND FLAVOPUNCTELIA (LICHENIZED ASCOMYCOTINA) FROM ARGENTINA

John A. Elix

Department of Chemistry, The Faculties, Australian National University, GPO Box 4, Canberra, ACT, 2601, Australia

Mónica T. Adler

Departamento de Ciencias Biológicas, Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires, 1428 Buenos Aires, Argentina

ABSTRACT : The species *Flavoparmelia glomelliferica* Elix & Adler, and *Flavopunctelia lobulata* Elix & Adler are described as new.

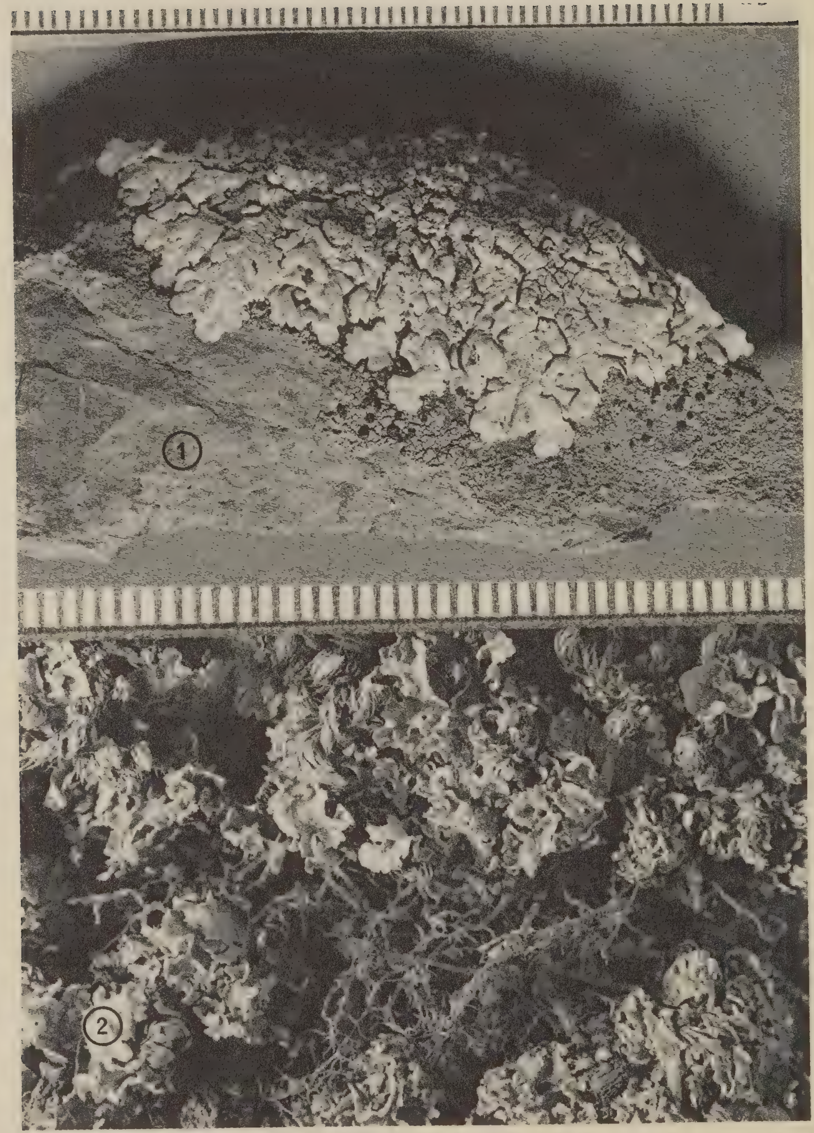
Throughout the present work chemical constituents were identified by thin layer chromatography (Culberson 1972; Culberson & Johnson 1982), high performance liquid chromatography (Lumbsch & Elix 1985) and by comparison with authentic samples.

Flavoparmelia glomelliferica Elix & Adler sp.nov. Figure 1

Species cum thallo ut in *Flavoparmelia baltimorensis* sed ab hac specie lobis angustioribus et arcte adnatis et acidum glomelliferum, acidum stenosporicum et acidum perlatolicum continente differt.
Type. Argentina. Provincia de SALTA. On rocks, 50 m above the road, Las Pailas, 2280m, *M.T.Adler*; BAFC-holotype, ANUC-isotype.

Thallus foliose, saxicolous, tightly adnate, yellow-green in colour, to 5 cm in diameter; *lobes* rotund, 1.0-3.0 mm wide, becoming laterally imbricate, ± contiguous, plane, irregularly divided. *Upper surface* broadly undulating, rugose centrally, dull for the most part, with reticulate white maculae towards the apices, apices shiny, black margined; dactylate, dactyls laminal on older lobes, large, thick, simple or sparingly branched, forming isidioid-pustules, fragile, breaking open apically but rarely forming granular soredia; medulla white; *lower surface* black with a very narrow naked brown rim, sparsely rhizinate, rhizines short, simple or tufted at the apices, concolorous with the lower surface. *Apothecia* and *pycnidia* not seen.
Chemistry. Cortex K-, medulla K-, C-, KC+ pale purple, P- ; containing usnic acid, glomelliferic acid (major), stenosporic acid (minor), perlatolic acid (minor), unknowns (traces).

This new species is characterised by the tightly adnate, thick, coriaceous thallus, the relatively narrow lobes (1-3 mm) and the production of erumpent dactyls and medullary glomelliferic acid. The erumpent dactyls produced by this species closely resemble those



Figures. New species of Parmeliaceae. 1 *Flavoparmelia glomelliferica* (holotype in BAFC); 2 *Flavopunctelia lobulata* (isotype in ANUC). Scale in mm.

of *Flavoparmelia baltimorensis* (Gyelnik) Hale, but the latter is distinguished by the more loosely adnate, thinner, almost papery, thallus, the broader (2-6 mm) lobes, and the production of medullary protocetraric acid and caperatic acid. Depsides are very rare in this genus [*F. helmsii* (Filson) Hale contains barbatic acid, a β-orcinol *para*-depside] and *F. glomelliferica* is the first representative known to produce an orcinol *para*-depside. This species is very rare and at present is known only from the type locality.

Flavopunctelia lobulata Elix & Adler sp.nov. Figure 2

Species cum thallo ut in *Flavopunctelia praesignis* sed ab hac specie thallo terricola, fragile et dense lobulato ad centrum differt.
Type. Argentina. Provincia de SALTA. Over mosses on soil, 50 m above the road, Las Pailas, 2280m, *M.T.Adler*; BAFC 35.931-holotype, ANUC, NY-isotypes.

Thallus foliose, terricolous, fragile, adnate or loosely attached, yellow to pale yellow-green, to 8 cm in diameter; *lobes* irregular, 1.0-4.0 mm wide, imbricate, with ascending ± pruinose margins, developing dense marginal and laminal lobulae in the thallus centre, lobulae suberect, dorsiventral, with pruinose margins, 0.5-1.0 mm wide. *Upper surface* opaque, maculate subapically, pseudocyphellate, *pseudocyphellae* dense, punctiform, elongate or eventually reticulate, commonly elevated or with raised margins, lacking soredia and isidia; medulla white. *Lower surface* black with a broad, naked, glossy, yellow to brown marginal zone, sparsely rhizinate, rhizines black, simple, short. Apothecia and pycnidia not seen.
Chemistry. Cortex K-, medulla K-, C+ red, P-; containing usnic acid, lecanoric acid (major), orsellinic acid (trace).

This species is characterised by the terricolous substrate and by the production of dense, suberect lobulae in the thallus centre. This species would appear to be closely related to *F. praesignis* (Nyl.) Hale. However *F. praesignis* is normally corticolous and the thalli are large (6-15 cm diam.), coriaceous, with broad lobes (7-15 mm wide) which are elobulate or, rarely, produce poorly developed laminal lobulae and have epruinose margins. By contrast *F. lobulata* is terricolous, with smaller (4-8 cm diam.), brittle thalli with narrower (1-4 mm wide) lobes which are densely lobulate centrally and have pruinose margins. At present this species is known only from the type locality.

Climate and Vegetation at the Collection Site

Las Pailas (25°05'S, 66°11'W) is situated above the river Las Arcas, near Cachi in the Argentine Province of Salta. The vegetation around the collection site typically represents the *cardonal* community, an arbustive steppe with abundant tall cacti, *Trichocereus pasacana* or cardón. This community is one of the principal types distinguished in the Prepuna Phytogeographic Province, and extends over the dry slopes of the mountains of north-west Argentina.

There is very little climatic data for this phytogeographic region. Nevertheless two localities in the Argentine Province of Jujuy (Humahuaca and Tumbaya) can be considered as representative, with mean annual temperatures of 10.4°C and 13.6°C, and mean annual rainfall of 175 mm and 179 mm respectively. In general the climate can be considered dry and warm with rain falling exclusively in summer (Cabrera 1976). The unusual combination of climatic features may well account for the number of rare or endemic lichens from the area (see also Nash, Elix & Johnston 1986).

ACKNOWLEDGEMENTS

We wish to thank Ms. Jen Johnston for suggestions to the manuscript, the staff of the Science Photographic Unit, ANU, for preparing the photographs, Mr. D. Verdon for checking the Latin descriptions, Dr. G. A. Jenkins and Ms. J. Johnston for determining the chemistry. We thank the Argentine National Research Council (CONICET) for a Fellowship to M.T.Adler.

LITERATURE CITED

Cabrera, A. L. (1976). Regiones Fitogeográficas Argentinas. Enciclopedia Argentina de Agricultura y Jardinería. Tommo II, Fascículo 1, Segunda Edición. Editorial ACME S. A. C. I. Beunos Aires.

Culberson, C. F. (1972). Improved conditions and new data for the identification of lichen products by a standardized thin-layer chromatographic method. *J. Chromatogr.*, **72**, 113-125.

Culberson, C. F. and Johnson, A. (1982). Substitution of methyl *tert.*-butyl ether for diethyl ether in the standardized thin-layer chromatographic method for lichen products. *J. Chromatogr.*, **238**, 483-487.

Lumbsch, H. T. and Elix, J. A. (1985). A new species of the lichen genus *Diploschistes* from Australia. *Pl. Syst. Evol.*, **150**, 275-279.

Nash, T. H. III, Elix, J. A., & Johnston, J. (1986). New species, new records and key for Xanthoparmelia (lichenized Ascomycotina) from South America. *Mycotaxon*, **28**, 285-296.

MYCOTAXON

Vol. XXX, pp. 339-344 October-December 1987

THREE NEW SAXICOLOUS SPECIES IN PARMELIACEAE (LICHENIZED ASCOMYCOTINA) FROM ARGENTINA

Mónica T. Adler

Departamento de Ciencias Biológicas, Facultad de Ciencias Exactas y Naturales,
Universidad de Buenos Aires, 1428 Buenos Aires, Argentina

John A. Elix

Department of Chemistry, The Faculties, Australian National University, GPO Box 4,
Canberra, ACT, 2601, Australia

ABSTRACT : The species *Canomaculina tandilensis* Adler & Elix, *Canomaculina ventanica* Adler & Elix and *Parmelinopsis bonariensis* Adler & Elix are described as new. The latter two species are known only in the low mountain and hill formations of southern Buenos Aires Province, Argentina but *C. tandilensis* has also been collected in Uruguay.

Recently the lichen genus *Parmelina* Hale (Hale 1974, 1976) was subdivided into six more homogeneous taxa (Elix & Hale 1987), namely *Canomaculina* Elix & Hale, *Myelochroa* (Asahina) Elix & Hale, *Parmelinella* Elix & Hale, *Parmelinopsis* Elix & Hale, *Parmotremopsis* Elix & Hale and *Parmelina* sens. str. Two of the new species described in this paper belong to *Canomaculina*, and the third to *Parmelinopsis*. In the present work chemical constituents were identified by thin layer chromatography (Culberson 1972; Culberson & Amman, 1979; Culberson, Culberson & Johnson 1981; Culberson & Johnson 1982) and high performance liquid chromatography (Lumbsch & Elix 1985) and by comparison with authentic samples.

Canomaculina tandilensis Adler & Elix sp.nov. Figure 1

Thallus saxicola, adnatus, 10-50 cm latus, cinereus, coriaceus, lobi irregulariter flabellati, 2-5 mm lati basi, profunde incisi, lobulos rectos crenatos vel incisos 1-2 mm latos formantes, margo nigricans copiose ciliati; cilia robusta, contracta, 0.1-2.0 mm longa, simplicia raro furcata; superne insigniter effigurato-maculatus; subtus niger, fuscus in zona lata subter apices loborum, sparse vel modice rhizinosus, rhizinis nigris simplicibus robustis; stratum gonidiale continuum vel interruptum, tunc algae aggregatae fasciculos triangulos formant; medulla alba; apothecia rara, substipitata; discis fuscis, planis, imperforatis, 2-5 mm diametro , asci 8-spori ; sporae ellipsoideae 5-9 x 9-14 µm; pycnidia laminalia, conidiis filiformibus, 5-11 µm longae; substantiae thalli atranorinum , chloroatranorinum, acidum salzinicum et acidum virensicum.
Type. Argentina. Buenos Aires Province. On granite rock, on hill above "La Cascada", Tandil, Partido de Tandil, 37°20'S , 59°09'W, 350m, *M.T.Adler*; i. 1987; BAFC 35.901-holotype, ANUC, US -isotypes.

Thallus saxicolous, adnate, grey, coriaceous, forming rosettes 10-50 cm in diameter; *lobes* irregularly flabellate, 2-5 mm wide at the base, deeply incised, becoming laciniate-lobulate, lobulae 1-2 mm wide, black margined, ciliate; *cilia* dense, mainly simple, robust and tapered, 0.1-2.0 mm long. *Upper surface* distinctly effigurate-maculate in older lobes, but apices shiny and with scattered maculae. *Lower surface* black, sparsely to moderately rhizinate, rhizines robust, concolorous with the lower surface, mainly simple, with a broad, dark brown marginal zone which is bare, papillate or sparsely rhizinate. *Upper cortex* from 15-25 μm (where the algal layer is thick) to 75-85 μm (where it is thin or interrupted); the *algal layer* usually consisting of triangular or trapezoidal algal packets 50-70 μm high, ± united at the base. *Medulla* white, 110-200 μm thick. *Lower cortex* 10-17 μm thick. *Apothecia* uncommon, substipitate, disc dark brown imperforate, 2-5 mm diam., spores (8); hyaline, ellipsoid, 5-9 x 9-14 μm. *Pycnidia* frequent, laminal; conidia filiform, 5-11 μm long.
Chemistry. Cortex K+ yellow, medulla K+ yellow turning dark red, P+ orange; containing atranorin, chloroatranorin, salazinic acid (major), virensic acid (variable, major to traces), consalazinic acid (minor), protocetraric acid (traces).

This species is readily recognised as a member of the small genus *Canomaculina* Elix & Hale by the following diagnostic combination of characters: the grey, effigurate-maculate upper cortex containing atranorin and chloratranorin, the subirregular lobes, the densely ciliate margins with robust, tapered cilia and the filiform conidia.
The spore and conidial dimensions are slightly below the ranges given by Elix & Hale for *Canomaculina,* but the form of the conidia (filiform) are characteristic of this genus. This new species is frequent on rocks in exposed situations around Tandil City.

Specimens Examined
ARGENTINA. Buenos Aires Province. On granite, near "Cerro Centinela", Tandil, 200 m, *M. T. Adler* , i.1987 (NY, paratype); on footpath to "Cerro Centinela", Tandil, *M. T. Adler* , i.1987 (BAFC 35.902); at the base of rocks with an easterly aspect, "La Movediza", Tandil, *M. T. Adler* , i.1987 (BAFC 35.903, 35.904); Sierra "La China", Olavarria, *M. T. Adler* , iii.1986 (BAFC 35.761).
URUGUAY. Punta Colorada. On stones in meadow, Maldonado, *H. S. Osorio 4552,* 28.xi.1960 (US).

Canomaculina ventanica Adler & Elix sp. nov. Figure 2

Species cum thallo et substantiis ut in *Canomaculina tandilensis* sed ab hac specie praesentia pustularum sorediatorum differt.
Type. Argentina. Buenos Aires Province. On rocks, Arroyo Los Helechos, Sierra de La Ventana, Partido de Tornquist, 38°08'S , 61°53'W, 250m, *M.T.Adler*; v.1986; BAFC 35.762-holotype, ANUC-isotype.

Thallus saxicolous, adnate, grey, coriaceous, forming rosettes to 20 cm in diameter; *lobes* irregularly flabellate, 2-5 mm wide at the base, apices incised, apical laciniae 1-2 mm wide, black margined, ciliate; *cilia* dense, mainly simple, robust and tapered, 0.1-2.0 mm long. *Upper surface* distinctly effigurate-maculate in older lobes, but apices shiny with scattered maculae, densely pustulate-sorediate, *soredia* developing from submarginal pustules, ultimately spreading over the surface of older lobes, coarse, granular. *Lower surface* black, dark brown at the apices, sparsely to moderately rhizinate, rhizines robust, concolorous with the lower surface, simple or rarely furcate, the marginal zone papillate or sparsely rhizinate. Mature apothecia and pycnidia not seen.
Chemistry. Cortex K+ yellow, medulla K+ yellow turning dark red, P+ orange; containing atranorin, chloroatranorin, salazinic acid (major), virensic acid (major), protocetraric acid (minor) and consalazinic acid (minor).

The thallus of *C. ventanica* closely resembles that of *C. tandilensis* but is less caespitose as it has fewer, shorter lobules. *C. ventanica* is readily distinguished by the presence of submarginal pustules which at maturity become granular-sorediate. Both species contain the same cortical and medullary substances, but virensic acid is commonly present in higher concentrations and is more consistently distributed throughout the thallus of *C. ventanica* than of *C. tandilensis*. Although no mature apothecia or pycnidia were observed other diagnostic features of the thalli indicate that this species belongs to the genus *Canomaculina* Elix & Hale. *C. ventanica* is the pustulate-sorediate morph of *C. tandilensis* and the fifth species recognized for this genus.

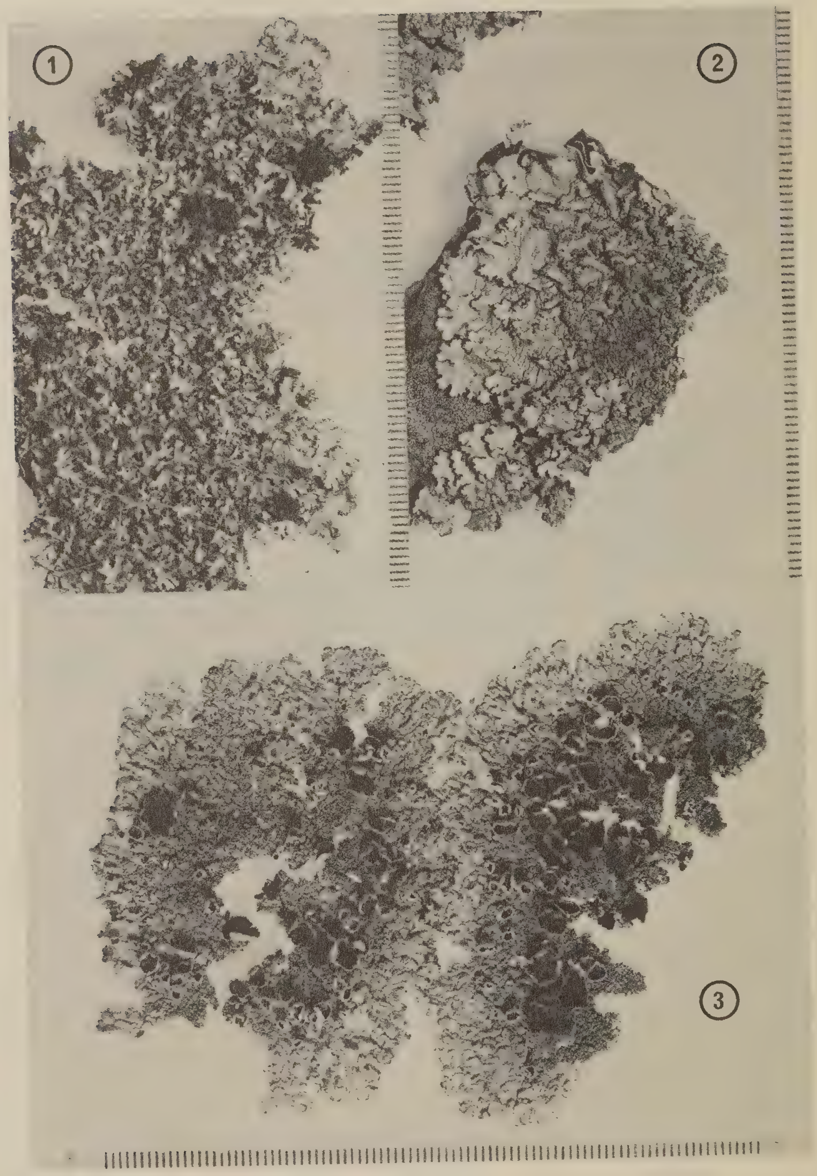
Specimens Examined
ARGENTINA. Buenos Aires Province. On rocks with a northerly aspect, Abra de La Ventana, Sierra de La Ventana, 350 m, *M. T. Adler* , v.1986 (NY-paratype); Parque Forestal Provincial, Sierra de La Ventana, *M. T. Adler* , v.1986 (US-paratype); on footpath to "Cerro Centinela", near "Cerro Centinela", Tandil, *M. T. Adler*, i.1987 (BAFC 35.905-paratype).

Parmelinopsis bonariensis Adler & Elix sp. nov. Figure 3

Thallus saxicola, fragilis, cinereus vel griseus in partibus juvenibus et olivaceus tinctus in centro, orbicularis, 2-8 cm latus, substrato arcte adnatus et adhaerens, lobi sublineares, 1-3 mm lati, ramificatione irregulari vel subdichotoma et apicibus plus minusve truncatis vel acutis, margo sparsim vel plus minusve dense ciliatus, cilia 0.2-1.0 mm longa vel interdum breviter dentiformes; superne maxime leviter maculatus vel emaculatus, laevis ad lobos undascens versus centrum tunc corrugatus; stratum algarum continuum et medulla alba; subtus niger, laete fuscus vel ochraceus ad apices loborum, vix vel modice rhizinatus, rhizinae nigrae vel fuscae, furcatae, dichotomae vel squarrosae. Apothecia numerosa, adnata vel substipitata, in centro thalli sita, discis fuscis, 3-10 mm diametro, asci octospori, sporis 5-9 x 10-13 µm, episporio circa 1 µm crasso; pycnidia laminalia, immersa, conidiis bifusiformibus, 4-8 µm longis; substantiae thalli atranorinum, chloroatranorinum, et acidi 3-methoxy-2,4-di-O-methyl -gyrophoricum, gyrophoricum, umbilicaricum et una substantia ignota.
Type. Argentina. Buenos Aires Province. On granite, source of Arroyo del Fuerte, near "La Cascada", Tandil, Partido de Tandil, 37°20'S , 59°09'W, 300m, *M.T.Adler*; i. 1987; BAFC 35.906-holotype, ANUC, NY, US -isotypes.

Thallus saxicolous, tightly adnate, fragile, ash grey or pearl grey in the younger parts but the centre becoming olivaceous, orbicular, 2-8 cm diam.; *lobes* sublinear-elongate 1-3 mm wide, subirregular to subdichotomously branched, apices truncate to subacute, margins sparsely to densely ciliate, *cilia* slender, short, 0.2-1.0 mm long, sometimes appearing only as denticles. *Upper surface* emaculate or rarely weakly maculate, apices smooth, becoming undulate and ultimately rugose-wrinkled (cerebriform) centrally, lacking soredia and isidia. *Lower surface* black, apices light tan to yellow-brown, sparsely to moderately rhizinate, the rhizines concolorous with the lower surface, simple, furcate, dichotomously branched or squarrose. Algal layer continuous, medulla white. *Apothecia* common, laminal, adnate to substipitate, 3-10 mm diam., disc brown, imperforate, with pearl grey amphithecia, spores (8); hyaline, ellipsoid, 5-9 x 10-13 µm, the epispore *ca.* 1 µm thick. Pycnidia common, laminal, immersed; conidia bifusiform, 4-8 µm long.
Chemistry. Cortex K+ yellow; medulla K-, C-, KC+ pink-violet, turning orange-red, P-; containing atranorin, chloroatranorin, 3-methoxy-2,4-di-O-methylgyrophoric acid, gyrophoric acid, umbilicaric acid, hiascic acid (trace), and an unknown substance related to gyrophoric acid.

The following characters, present in this species, are characteristic of the genus *Parmelinopsis* Elix & Hale: narrow lobes with truncate apices, emaculate upper surface,



Figures. New species of Parmeliaceae. 1 *Canomaculina tandilensis* (holotype in BAFC); 2 *Canomaculina ventanica* (holotype in BAFC); 3 *Parmelinopsis bonariensis* (holotype in BAFC). Scale in mm.

margins with slender, ± uniformly dispersed cilia, relatively large spores, bifusiform conidia and medullary chemistry (hiascic acid - gyrophoric acid chemosyndrome).

Morphologically and chemically *P. bonariensis* resembles *P. damaziana* and *P. neodamaziana*, two other non-sorediate, non-isidiate species of this genus. However *P. damaziana* is a corticolous species with larger spores (16-18 x 10-12 µm), while *P. bonariensis* is a saxicolous species with smaller spores (10-13 x 5-9 µm). Although both contain 3-methoxy-2,4-di-O-methylgyrophoric acid (formerly known as the horrescens unknown) and gyrophoric acid, *P. damaziana* also contains 5-O-methylhiascic acid (absent in *P. bonariensis*) but lacks umbilicaric acid and the unknown substance related to gyrophoric acid, both present in significant quantities in *P. bonariensis*. On the other hand, the Australian endemic, *P. neodamaziana* (Elix & Johnston 1987) has a significantly smaller thallus (2-3 cm wide) with narrower (0.8-2.0 mm wide), more highly branched lobes than *P. bonariensis,* and although belonging to the same chemosyndrome, it differs chemically. Thus *P. neodamaziana* consistently contains gyrophoric acid (major), 5-O-methylhiascic acid, umbilicaric acid, 2,4,5-tri-O-methylhiascic acid and 2,4-di-O-methylgyrophoric acid but lacks 3-methoxy-2,4-di-O-methylgyrophoric acid.

P. bonariensis is a frequent species on rocks of the hills and low mountain formations (systems of Tandilia and Ventania) in the south-east and south-west of Buenos Aires Province. Usually it is found on rocks in protected, humid sites.

Specimens Examined

ARGENTINA. Buenos Aires Province. On rocks with a southerly aspect, at the base of Cerro Bahia Blanca, Abra de La Ventana, Sierra de La Ventana, 250 m, *G.Vobis & M. T. Adler* , v.1986 (BAFC 35.789, 35.790); on rocks with a northerly aspect, Abra de La Ventana, Sierra de La Ventana, *M. T. Adler* , v.1986 (BAFC 35.793); near "La Cascada", source of Arroyo del Fuerte, Tandil, *M. T. Adler* , i.1987 (BAFC 35.908).

ACKNOWLEDGEMENTS

We wish to thank Dr. J. E. Wright and Ms. Jen Johnston for suggestions to the manuscript; Mrs. H. H. de Ormazábal, Lic. M. Bernabé and Mr. A. Zamacona for assistance in field work ; Mr. D. Verdon for checking the Latin descriptions, Dr. G. A. Jenkins and Ms. Jen Johnston for determining the chemistry, and Dr. M. E. Hale Jr. (US) for the loan of critical collections. We thank the Consejo Nacional de Investigaciones Cientificas y Técnicas of Argentina (CONICET) for making this work possible through a Postgraduate Fellowship to M.T.Adler.

LITERATURE CITED

Culberson, C. F. (1972). Improved conditions and new data for the identification of lichen products by a standardized thin-layer chromatographic method. *J. Chromatogr.*, **72**, 113-125.

Culberson, C. F. & Ammann, K. (1979). Standardmethode zur Dünnschicht-chromatographie von Flechtensubstanzen. *Herzogia*, **5**, 1-24.

Culberson, C. F., Culberson, W. L. & Johnson, A. (1981). A standardized TLC analysis of β-orcinol depsidones. *Bryologist* , **84**, 16-29.

Culberson, C. F. and Johnson, A. (1982). Substitution of methyl *tert.*-butyl ether for diethyl ether in the standardized thin-layer chromatographic method for lichen products. *J. Chromatogr.*, **238**, 483-487.

Elix, J. A. & Hale, M. E. Jr. (1987). *Canomaculina, Myelochroa, Parmelinella, Parmelinopsis* and *Parmotremopsis,* five new genera in the Parmeliaceae (Lichenized Ascomycotina). *Mycotaxon*, **29**, 233-244.

Elix, J. A. & Johnston, J. (1987). New species of *Parmelina* (Lichenised Ascomycotina) from Australia and New Zealand. *Brunonia*, **9**, 155-161.

Hale, M. E. Jr. (1974). *Bulbothrix, Parmelina, Relicina*, and *Xanthoparmelia*, four new genera in the Parmeliaceae (Lichenes). *Phytologia*, **28**, 479-490.

Hale, M. E. Jr. (1976). A Monograph of the Lichen Genus *Parmelina* Hale (Parmeliaceae). *Smithsonian Contrib. Bot.*, **33**, 1-59.

Lumbsch, H. T. and Elix, J. A. (1985). A new species of the lichen genus *Diploschistes* from Australia. *Pl. Syst. Evol.*, **150**, 275-279.

MYCOTAXON

Vol. XXX, pp. 345-350 October-December 1987

NOTES ON HYPHOMYCETES. LV.
CRANEOMYCES GEN. NOV. AND TRICHOBOTRYS EFFUSA

GARETH MORGAN-JONES

Department of Plant Pathology, College of Agriculture and Alabama
Agricultural Experiment Station, Auburn University, Auburn, Alabama 36849

and

ROBERT C. SINCLAIR and ALBERT EICKER

Department of Botany,
University of Pretoria, Pretoria 0002, South Africa

ABSTRACT

Craneomyces verrucosus Morgan-Jones, Sinclair and Eicker, a new genus and species, is described and illustrated from a collection made on rotting wood in the Transkei, southern Africa. It is compared with *Trichobotrys effusa* (Berk. & Br.) Petch.

INTRODUCTION

A dematiaceous fungal anamorph with catenate conidia, collected on rotting wood in the Transkei, southern Africa, which resembles *Trichobotrys* Penz. & Sacc., has been determined to be hitherto undescribed and distinct enough to be classified in a new genus. It is described, illustrated, and compared with *Trichobotrys effusa* [= *T. pannosa* Penz. & Sacc.], the type species of *Trichobotrys*. The latter is also described and illustrated from a collection made in the Transvaal.

TAXONOMIC PART

Craneomyces gen. nov.

[Etymology: fungus (Gr. *mykes*) named in honor of Dr. J. Leland Crane, in recognition of his contributions to knowledge of fungal anamorphs, especially *Torula*-complex taxa.]

Fungus anamorphosis.

Coloniae effusae, atro brunneae vel nigrae, pilosae. Mycelium partim immersum, partim superficiale, ex hyphis ramosis, septatis, pallide brunneis, laevibus vel verruculosus compositum. Conidiophora macronemata, mononemata,

---

Alabama Agricultural Experiment Station Journal Series No. 18-871305

simplicia vel ramosa, cylindrica, recta, septata, brunnea, verrucosa. Cellae conidiogenae monoblasticae vel interdum polyblasticae, in conidiophoris incorporatae vel discretae, terminales vel laterales, cylindricae vel doliiformes, determinatae. Conidia sicca, in catenis acropetis simplicibus vel ramosis, aseptata, brunnea, globosa, verrucosa, parietibus crassis.

Species typica: *Craneomyces verrucosus* Morgan-Jones, Sinclair et Eicker.

Colonies effuse, dark brown to black, hairy. Mycelium partly immersed, partly superficial, composed of branched, septate, pale brown, smooth or verruculose hyphae. Conidiophores macronematous, mononematous, simple or branched, cylindrical, straight, septate, brown, verrucose. Conidiogenous cells monoblastic or sometimes polyblastic, integrated or discrete, terminal or lateral, cylindrical or barrel-shaped, determinate. Conidia dry, in simple or branched acropetal chains, aseptate, brown, globose, verrucose, thick-walled.

Craneomyces verrucosus sp. nov. (Figure 1).

Coloniae effusae, atrobrunneae vel nigrae, pilosae. Mycelium plerumque immersum et partim superficiale, ex hyphis ramosis, septatis, pallide brunneis, laevibus vel verruculosis, 2-3.5 µm crassis compositum. Conidiophora macronemata, mononemata, simplicia vel ramosa, cylindrica, erecta, recta, septata, brunnea, verrucosa, parietibus interdum pustuliformis, usque ad 480 µm longa, 3-4 µm crassa. Cellae conidiogenae monoblasticae vel interdum polyblasticae, in conidiophoris incorporatae vel discretae, terminales vel laterales, cylindricae vel doliiformes, determinatae. Conidia holoblastica, sicca, in catenis acropetis simplicibus vel ramosis, aseptata, brunnea, globosa, verrucosa, parietibus crassis, 4.5-5 µm diam.

In ligno emortuo, Mbotyi, Transkei, southern Africa, December 1982, R.C. Sinclair, AUA, holotypus.

Colony effuse, dark brown or black, hairy. Mycelium predominantly immersed to partly superficial, composed of branched, septate, pale brown, smooth 2-3.5 µm wide hyphae. Conidiophores macronematous, mononematous, simple or branched, cylindrical or sometimes narrowly clavate towards the apex, erect, straight or slightly flexuous, septate, brown, verrucose, frequently coarsely with ornamentation taking the form of blister-like protrusions, up to 480 µm long, 3-4 µm wide. Conidiogenous cells monoblastic or sometimes polyblastic, integrated or discrete, terminal or lateral, cylindrical or barrel-shaped, determinate. Conidia holoblastic, dry, in long, simple or branched acropetal chains, aseptate, brown, globose, verrucose, thick-walled, following detachment with a small, thin-walled area discernible at the point or points of attachment to a conidiogenous cell or adjacent conidia, 4-4.5 µm in diameter.

On dead wood, Mbotyi, Transkei, southern Africa, December 1982, R.C. Sinclair, AUA, type.

The long, strictly linear, chains of conidia give *Craneomyces verrucosus* a striking appearance and a superficial resemblance to such fungi as *Rutola graminis* (Desm.) Crane & Schoknecht [≡ *Torula graminis* Desm.], or even *Xylohypha lignicola* Sutton. The conidia do not appear to be as readily detached as those of the morphologically similar genera *Periconia* Tode and

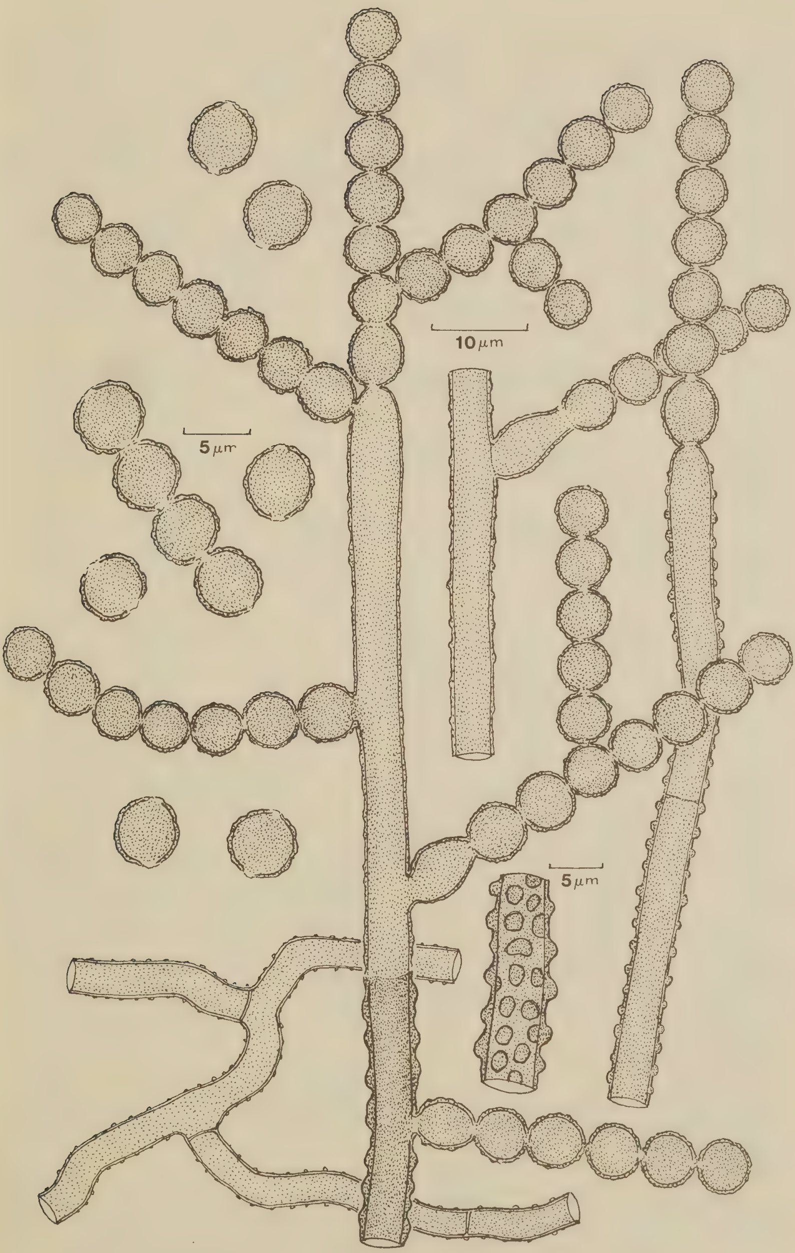

10 µm
5 µm
5 µm

FIGURE 1. *Craneomyces verrucosus*; hypha, conidiophores and conidia.

Trichobotrys, but are not as firmly attached as in *X. lignicola*. Conidia, both when attached and following secession, have an incompletely developed wall where they abut each other or a conidiogenous cell. A small, thin, pore-like area is readily evident. Conidiogenous cell morphology and conidiogenesis in *Craneomyces* and *Trichobotrys* are essentially similar. In the latter, however, conidiogenous cells have a tendency to assume a darker pigmentation than adjacent sterile conidiophore cells and conidia. Such color differentiated mother cells are not present in *C. verrucosus*. The conidial chains of *Trichobotrys* resemble those of *Periconia* rather than *Craneomyces* because of a botryose appearance. This results from chains originating at various points on the curved surface of mother cells. An additional distinguishing feature between *Craneomyces* and *Trichobotrys* lies in the fact that the conidiophore of the latter terminates in an attenuated, sterile, setiform apex whereas, in the former, the apex is invariably fertile.

A collection of *Trichobotrys effusa* has been made in South Africa and the fungus brought into culture. A description of it is provided for comparison with *C. verrucosus*.

Trichobotrys effusa (Berk. & Br.) Petch, *Ann R. Bot. Gdns Peradeniya* 9: 169, 1924 (Figure 2).

≡ *Sporodum effusum* Berk. & Br., Fungi of Ceylon, no. 898, 1857.

= *Trichobotrys pannosa* Penz. & Sacc., *Malpighia* 15: 245, 1902.

Colonies effuse, grayish to dark brown, velvety. Mycelium mostly immersed in the substratum, partly superficial, composed of branched, septate, smooth, subhyaline to pale brown, 2-4 µm wide hyphae. Conidiophores macronematous, mononematous, erect, straight or slightly flexuose, cylindrical,verruculose, septate, thick-walled, brown, moderately branched, up to 1 mm long, 4-6 µm wide, gradually attenuated distally to a sterile, setiform apex; lateral branches up to 22 µm long, generally paler than the main conidiophore axis, with individual cells often slightly inflated. Conidiogenous cells monoblastic or polyblastic, integrated and terminal on lateral branches or discrete as conidia/ramiconidia, determinate, barrel-shaped to subglobose or globose (conidial), subhyaline to brown, verruculose or echinulate, 6-10 X 5-7 µm, or 5-6 µm in diameter; terminal conidiogenous cells sometimes appreciably darker in color and thicker-walled than subtending sterile lateral branch cells. Fertile conidium-like elements sometimes remaining attached to lateral branch cells following conidial secession and becoming cupulate as a result of a collapse and invagination of the upper half of their wall. Conidia holoblastic, dry, in irregular, branched chains, acropetal, aseptate, brown, globose, minutely echinulate, 5-7 µm in diameter; conidial clusters botryose in appearance.

Plurivorous; cosmopolitan.

Collection examined: on decorticated wood, Pienaars River bank, junction of Bronkhorstspruit Road, Pretoria, Republic of South Africa, August 1979, R.C. Sinclair, AUA.

In culture on PDA, *T. effusa* produces dark brown to blackish, velvety colonies. Similar conidiophores to those occurring in nature are produced *in vitro*, except that the lateral branches are generally more deeply pigmented and

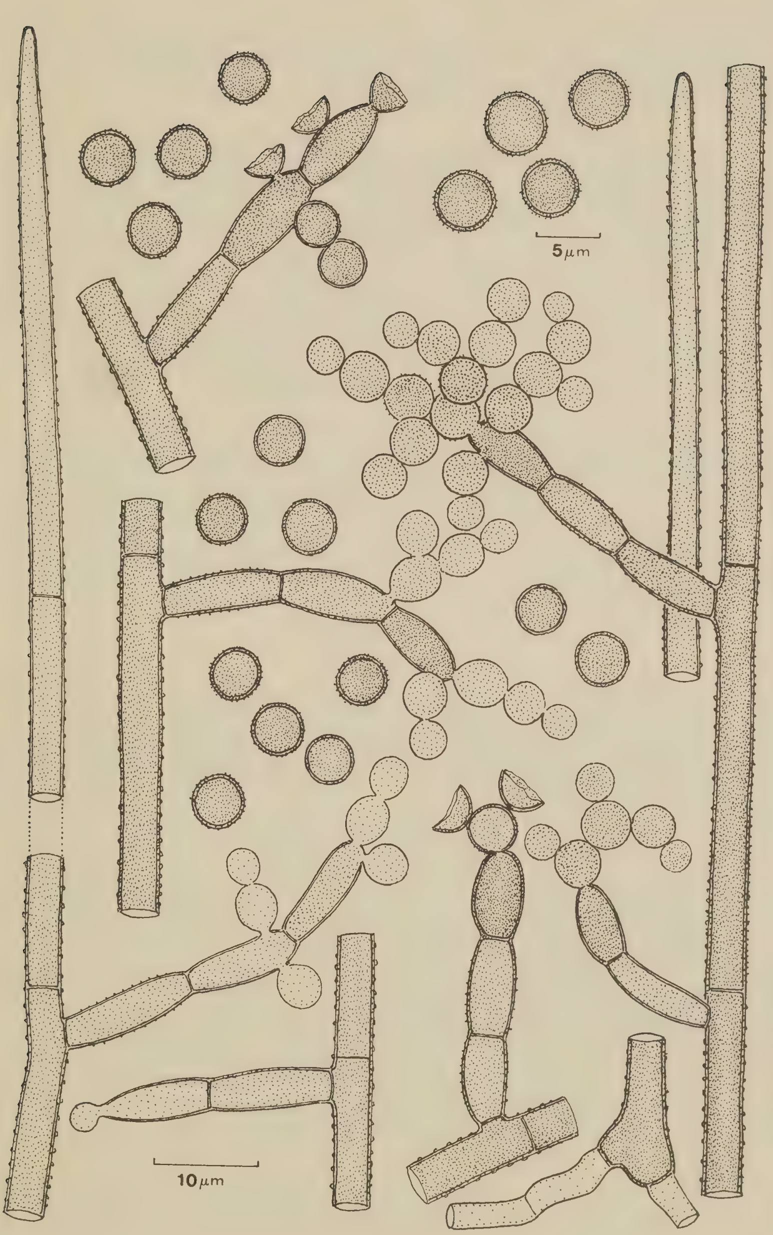


FIGURE 2. *Trichobotrys effusa*; conidiophores and conidia.

almost concolorous with the main axis. Surface ornamentation of both conidiophores and conidia is more pronounced in culture. Conidia of the South African collection of *T. effusa* are slightly larger than is normal in the species [3-5 µm in diameter fide Ellis (1971)].

The occurrence of cupulate structures derived from partly collapsed, globose conidiogenous cells is of interest since such entities are also present in *Dwayabeeja* Subramanian and *Lemkea* Morgan-Jones & Sinclair (Subramanian, 1958; Matsushima, 1975; Morgan-Jones and Sinclair, 1983), two other genera which produce holoblastic conidia. In *Lemkea sphaerospora* Morgan-Jones & Sinclair, the portion of the wall of such cells that invaginates appears to be thinner than elsewhere. In *T. effusa*, however, wall thickness does not, apparently, vary. Seemingly normal conidia, which function as conidiogenous cells but remain attached to lateral branches, fold in on themselves following detachment of those borne distally. The cupulate condition occurs less commonly in culture than in material from nature, indicating environmental influence.

Trichobotrys effusa was first described in the genus *Sporodum* Cda, type species *S. conopleoides* Cda [= *Periconia hispidula* (Pers.) Mason & M.B. Ellis], which is a synonym of *Periconia*. Its natural affinities are with the latter genus. Two species of *Periconia*, *P. hispidula* and *P. lateralis* Ell. & Everh., have the characteristic in common with *T. effusa* of having conidiophores with sterile, setiform apices. The only significant difference between the two genera is the presence of short, lateral, unciform conidiophore branches in *Trichobotrys*.

ACKNOWLEDGMENT

We thank Dr. J. Leland Crane, State Natural History Survey, Illinois, for examining material sent to him and confirming our determination of the uniqueness of *Craneomyces*. Both Dr. Crane and Dr. W. Bryce Kendrick, University of Waterloo, Ontario, Canada reviewed the manuscript. Two of us (R.C.S. and A.E.) are grateful to the University of Pretoria and the South African C.S.I.R. for financial support.

LITERATURE CITED

ELLIS, M.B. 1971. Dematiaceous Hyphomycetes. Commonwealth Mycological Institute. 608 pp.

MATSUSHIMA, T. 1975. Icones microfungorum a Matsushima lectorum. Kobe. Published by author.

MORGAN-JONES, G. and R.C. SINCLAIR. 1983. *Lemkea*, a new dematiaceous hyphomycete genus. *Mycologia* 75: 159-161.

SUBRAMANIAN, C.V. 1958. Hyphomycetes-IV. *J. Indian Bot. Soc.* 37:47-64.

MYCOTAXON

Vol. XXX, pp. 351-355 October-December 1987

NOTES ON HYPHOMYCETES. LVI.
CERATOSPORELLA CHEIROIDEA, A NEW SPECIES

ROBERT C. SINCLAIR and ALBERT EICKER

Department of Botany,
University of Pretoria, Pretoria 0002, South Africa

and

GARETH MORGAN-JONES

Department of Plant Pathology, College of Agriculture and Alabama
Agricultural Experiment Station, Auburn University, Auburn, Alabama 36849

ABSTRACT

Ceratosporella cheiroidea Sinclair, Morgan-Jones & Eicker, a new dematiaceous anamorph, is described from decorticated wood in the Transvaal, South Africa. It is compared with other species of the genus *Ceratosporella* Höhnel.

INTRODUCTION

Within the genus *Ceratosporella*, as presently constituted, there exist three kinds of conidial morphology. Conidia of its type species, *C. bicornis* (Morgan) Höhnel [≡ *Triposporium bicorne* Morgan], as the specific epithet indicates, are bifurcate, each with two horn-like branches originating from a basal cell. Rambelli (1958) described a species, *C. goidanichii* Rambelli, with cylindrical unbranched conidia but, as Hughes (1971) has pointed out, it cannot be considered congeneric with *C. bicornis*. The same fungus was subsequently given the name *Endophragmia alternata* Tubaki & Saitô (1969) and is now classified as *Sporidesmium goidanichii* (Rambelli) S. Hughes (Hughes, 1979; Kirk 1982). *Ceratosporella deviata* Subram. and *C. lambdaseptata* Matsushima have stauriform conidia that resemble in shape those of *Triposporium* Cda. The latter species might, in fact, be more appropriately classified in *Triposporium* since its conidia have the stalk cell and three radiating conidial arms, originating from cells above it, characteristic of that genus. A third group, to which *C. novae-zelandiae* Hughes, *C. ponapensis* Matsushima and *C. stipitata* (Goidānich) Hughes [≡ *Speira stipitata* Goidānich] belong, has cheiroid conidia. A fourth species possessing conidia of the latter type has been discovered during the course of collecting microfungi on decorticated wood at Mariepskop on the northeastern Transvaal escarpment, South Africa, and is described herein.

Alabama Agricultural Experiment Station Journal Series No.18-871314

TAXONOMIC PART

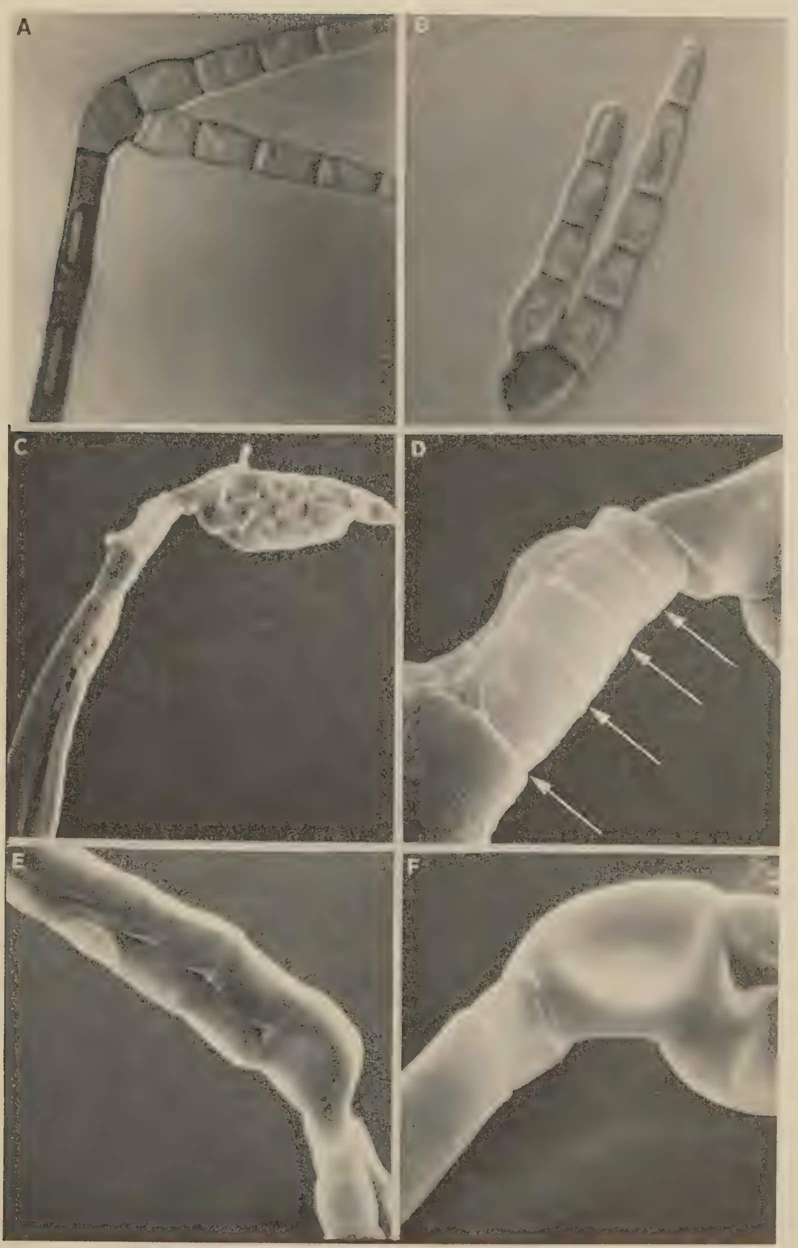
Ceratosporella cheiroidea Sinclair, Morgan-Jones et Eicker (Plate 1, figure 1).

Coloniae effusae, brunneae vel atrobrunneae, sparsae, pilosae. Mycelium superficiale et immersum, ex hyphis ramosis, septatis, pallide brunneis vel brunneis, laevibus, 3-5 µm crassis compositum. Conidiophora macronemata, mononemata, ex hyphis superficialibus repentibus terminalia ad lateralia oriunda, simplicia, erecta, recta, raro flexuosa, brunnea, interdum apicem versus pallidiora, laevia, septata, cylindrica, parietibus crassis, usque ad 230 µm longa X 5-7 µm crassa, apicem versus 4.5-5 µm crassa, cum 0-6 proliferationibus terminalibus successivis, ad basim 9-12 µm crassa. Cellulae conidiogenae holoblasticae, monoblasticae, in conidiophoris incorporatae, terminales, determinatae vel percurrentes. Conidia acrogena, solitaria, sicca, laevia, subhyalina vel pallide brunnea, guttulata, digitata, cheiroidea, ex cellula basali communi et 2-3 ramulis composita. Ramuli cylindrici, plerumque leniter curvati vel aliquando recti, plerumque adpressi, raro divergentes, apicem versus attenuati, 1 ad 6-septati, ad septa leniter constricti, 18-50 µm longi, 4-7 µm crassi; ramulus primariis 4 ad 6-septatus, 45-50 µm longus, ramulus lateralibus secundariis 2 ad 4-septatus, 36-48 µm longus et ramulus tertiariis 0 ad 3-septatus, 18-40 µm longus. Cellula basalis brunnea, obconica, ad basem truncata, 8.5-9 µm crassa.

In ligno emortuo, Mariepskop, Transvaal, South Africa, September 1984, R.C. Sinclair, AUA, holotypus.

Colonies effuse, brown to dark brown, sparse, hairy. Mycelium partly superficial, mostly immersed, composed of branched, septate, pale brown to brown, smooth, 3-5 µm wide hyphae. Conidiophores macronematous, mononematous, arising terminally or laterally from the repent superficial hyphae, unbranched, erect, straight or rarely slightly flexuous, brown, sometimes paler towards the apex if proliferated, smooth, septate, cylindrical, thick-walled, up to 230 µm long, 5-7 µm wide, 4.5-5 µm wide towards the apex, with none or up to six successive, terminal proliferations, up to 12 µm wide at the irregularly swollen base. Conidiogenous cells holoblastic, monoblastic, integrated, terminal, determinate or percurrent. Conidia acrogenous, solitary, dry, smooth, subhyaline to pale brown, guttulate, digitate, cheiroid, made up of a basal cell bearing two to three upwardly-directed, finger-like branches of varying length, detaching schizolytically. Branches cylindrical, frequently slightly curved or more or less straight, often appressed against each other, rarely divergent, attenuated towards the apex, 1 to 6-septate, slightly constricted at the septa, 18-50 µm long, 4-7 µm wide, not arising synchronously; primary branch generally longer, 45-50 µm, and 4 to 6-septate, secondary and tertiary branches shorter, 36-48 µm and 18-40 µm and, in a given conidium, with fewer septa, 2 to 4 and 0 to 3, respectively. Tertiary branch, when present, may originate from the basal cell or from the lower cell of the secondary branch. Basal cell mid brown, broadly obconical, with a truncate base, 8.5-9 µm wide.

PLATE 1. *Ceratosporella cheiroidea*. A, conidiophore with obliquely oriented conidium; B, conidium; C, SEM of conidiophore and conidium; D, SEM of conidiophore apex and base of detaching conidium (annellations indicated by arrows); E & F, SEM of conidiophore apices and attached conidia.


A
B
C
D
E
F

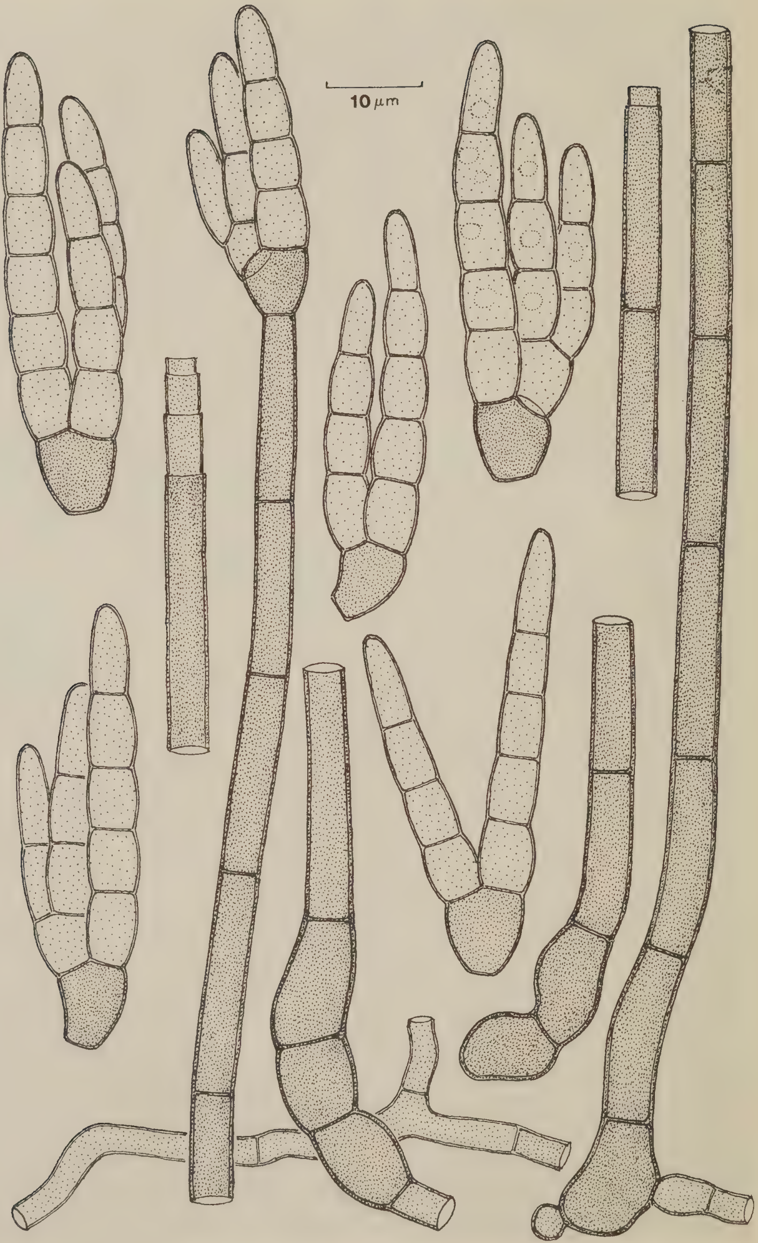


FIGURE 1. *Ceratosporella cheiroidea*. Conidiophores and conidia.

On dead wood; South Africa

Collection examined: Mariepskop, Transvaal, South Africa, September 1984, R.C. Sinclair, AUA, type.

Ceratosporella cheiroidea is easily distinguishable from all other species of the genus by the morphology of its conidia. Its conidiophores are very similar to those of *C. novae-zelandiae* which proliferate percurrently in the same way and bear a series of up to eight annellations. The degree of elongation as a result of each successive proliferation varies (Plate 1,D), generally becoming progressively shorter. The conidia of *C. cheiroidea* also have something of the aspect of those of *C. novae-zelandiae*, but are better developed, both in terms of length and number of branches and constituent cells. In common with *C. novae-zelandiae*, which invariably has only two conidial branches, the main conidial axis is slightly curved and conidia may be oriented obliquely on the conidiophore (Plate 1, A). Secondary and tertiary branches assume a position lateral to the main axis and, when all three branches are slightly curved, the former are curved in the opposite direction to the primary one. In any given conidium of *C. cheiroidea*, the three branches, which often appear to lie in more or less one plane, are of decreasing length from the primary through the secondary to the tertiary. In *C. novae-zelandiae* also, the secondary branch is shorter than the primary one. The conidiophores of *C. ponapensis* and *C. stipitata* differ from those of the two species discussed above in being appreciably shorter and non-proliferating. Those of *C. stipitata* also have the characteristic of being closely septate. The conidia of both of these taxa are much more elaborate than those of *C. cheiroidea* and their conidial branches longer. Conidial branches of *C. stipitata*, which are frequently somewhat undulate and closely appressed along most of their length, are broadly obtuse at the apex in contrast with those of *C. cheiroidea* which are more subulate. The darkly pigmented basal cell, with appreciably paler branches above, is an additional distinguishing feature of *C. cheiroidea*. The basal cell and branches of *C. ponapensis* and *C. novae-zelandiae* are more or less concolorous although in both species branches become gradually paler towards their apices. A basal cell that is somewhat darker than the remainder of the conidial cells also occurs in *C. deviata* a species with widely divergent conidial branches.

ACKNOWLEDGMENT

We thank Dr. Roger D. Goos, University of Rhode Island, for reviewing this manuscript. The senior authors wish to gratefully acknowledge the financial support of the University of Pretoria and the South African C.S.I.R.

LITERATURE CITED

HUGHES, S.J. 1971. New Zealand Fungi 16. *Brachydesmiella, Ceratosporella. N.Z. J. Bot.* 9: 351-354.

HUGHES, S.J. 1979. Relocation of species of *Endophragmia* auct. with notes on relevant generic names. *N.Z. J. Bot.* 17: 139-188.

KIRK, P.M. 1982. New or interesting microfungi. V. Microfungi colonizing *Laurus nobilis* leaf litter. *Trans. Br. mycol. Soc.* 78: 293-303.

RAMBELLI, A. 1958. Micromiceti della Foresta di Campigna, II Contributo. *Atti Accad. Sci. Ist. Bologna, Ser.* XI, 5: 1-15.

TUBAKI, K. and T. SAITO. 1969. *Endophragmia alternata* sp. nov. and other hyphomycetes on *Pinus* leaves in Japan. *Trans. Br. mycol. Soc.* 52: 477-482.

MYCOTAXON

Vol. XXX, pp. 357-405 October-December 1987

THE XERULA (COLLYBIA, OUDEMANSIELLA) RADICATA COMPLEX IN CANADA

S.A. REDHEAD, J. GINNS AND R.A. SHOEMAKER

Biosystematics Research Centre, Agriculture Canada
Ottawa, Ontario, Canada, K1A 0C6

ABSTRACT

Xerula sect. *Radicatae* in Canada is represented by four taxa with ranges extending south into the U.S.A. *Xerula furfuracea* (= *Collybia radicata* var. *furfuracea*) differs from *X. radicata* by the presence of thick-walled pileocystidia, and by large projecting caulocystidia. *Xerula megalospora* (= *Clitocybe megalospora*) is in part characterized by the production of an orange necropigment after exposure to napthalene for one year. Capitate cheilocystidia and pleurocystidia, thin-walled pileocystidia, and finely roughened basidiospores (LM) are other distinguishing features. *Xerula rubrobrunnescens* sp. nov., has capitate pleurocystidia, a gelatinized, stratose lamellar trama, and finely roughened basidiospores. *Xerula rugosoceps* (= *Collybia rugosoceps*) has small basidiospores and a prominently plicate-rugose pileus.

Xerula radicata var. *radicata* has not been confirmed from Canada but does occur in the U.S.A. where it is rare. *Xerula radicata* var. *bispora* var. nov., a bisporous taxon which lacks clamp connections, is known from Europe and the U.S.A. Several collections, in poor condition, from the U.S.A. were tentatively identified as *Xerula radicata* var. *africana*.

The cultural characters of *X. furfuracea* and *X. megalospora* were similar. Both produce crustose patches of cuticular and interlocking cells and both have unifactorial mating systems.

INTRODUCTION

Both the genera *Oudemansiella* Speg. and *Xerula* Maire have been shown to produce an interesting and promising group of antibiotics, the strobilurins and oudemansins (Anke 1985). It is essential that the species in these genera be accurately determined if studies on antibiotics in different species are conducted. In Europe these genera have been intensively studied in recent years (Boekhout and Bas 1986; Clémençon 1979; Dörfelt 1973, 1979, 1980a & b, 1981a & b, 1983a & b, 1984, 1985, 1986; Moser 1955; Pegler and Young 1987; Szczepka and Sokol 1986). In the two latest revisions of section *Radicatae*, combined either with *Oudemansiella* or *Xerula* (Dörfelt 1983a, Pegler and Young 1987), the North American elements were not treated in detail. For over 70 years North American mycologists have been aware of a large-spored form of *Xerula radicata* (Rehlan: Fr.) Dörfelt sensu lato, in which the lamellae become bright orange in dried herbarium specimens (Murrill 1915). Hesler (1951) noted that the pigmented lamellae became orange-cinnamon, English red, xanthine orange, zinc orange, or orange rufous (Ridgway 1912). In 1955, J.W. Groves of Ottawa and A.H. Smith of Ann Arbor exchanged correspondence regarding this phenomenon without resolving the taxonomic problems. Groves (in litt.) noted that collections in DAOM could be clearly separated into two groups. Smith, in his correspondence, and in a later publication (Mitchel and Smith 1978), suggested that exposure to napthalene initiated the change in colour, but he was not convinced that all collections in this complex could be sorted into two groups. In the summer of 1955, R.A. Shoemaker divided in half a freshly dried pileus representing the large-spored taxon which was known to change to orange. Half was placed on napthalene flakes in an open dish, the other half was placed in a corked vial containing paradichlorobenzene. By March, 1956 the lamellae on the half exposed to napthalene had become orange while the lamellae exposed to paradichlorobenzene remained unchanged. The taxonomic questions posed by these observations have remained unanswered in the intervening years.

MATERIALS

Collections labelled either *Collybia radicata* (Rehlan: Fr.) Kummer or *Oudemansiella radicata* (Rehlan: Fr.) Singer in BPI, DAOM, NY, QFB and TRTC were examined microscopically and sorted on the basis of micromorphological differences. North American type specimens for the names *Clitocybe megalospora* Clements in Clements and Pound (1896), *Collybia radicata* var. *furfuracea* Peck (1892), *C. radicata* var. *pusilla* Peck (1896), *Collybia rugosoceps* Atkinson (1902), *Agaricus (Collybia) texensis* Berkeley and Curtis (1853) and *Collybia umbrina* Clements in Clements and Pound (1896), which have been linked to the genera *Oudemansiella* or *Xerula* (Bigelow 1985, Halling 1983, Murrill 1915, 1916, Smith 1949), were examined also.

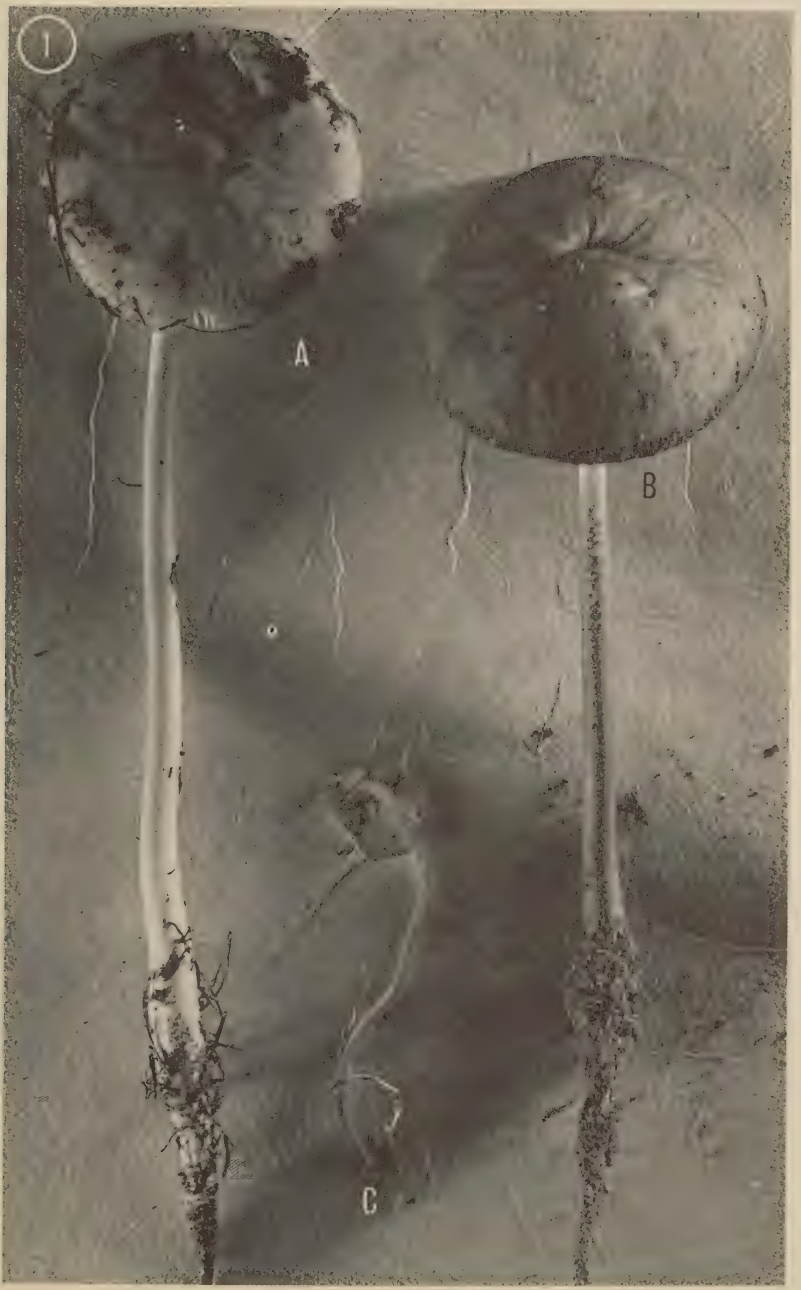
Fresh materials of *Xerula furfuracea*, *X. megalospora* and *X. rubrobrunnescens* from the Ottawa valley region were studied. Colours were compared to those in Rayner (1970). Data on dikaryon and monokaryon cultures of both *X. furfuracea* and *X. megalospora* were obtained. Colours of cultures are compared to those in the Munsell Book of Color (1929-1942).

RESULTS

Aside from some obvious generic misdeterminations, the remaining related specimens could be clearly assigned to seven taxa. The commonest North American taxon was represented by the type of *Collybia radicata* var. *furfuracea*. This fungus is characterized by a furfuraceous stipe (Figs. 1b, 3) clothed by dense fascicles of erect

---

Fig. 1a. *Xerula megalospora*, note smooth stipe. 1b & c. *Xerula furfuracea*, note furfuraceous stipe; ca. life size, specimens not retained.


1
A
B
C

and prominent caulocystidia (Fig. 13), erect pileocystidia with thickened walls in age (Figs. 8, 12, 21), cylindrical pleurocystidia with truncated apices (Figs. 9, 15), fusoid to ventricose cheilocystidia (Figs. 6, 10, 17), and ovoid spores (Figs. 18-19) appearing smooth under the light microscope. The second most commonly collected North American fungus has been described under the names *Clitocybe megalospora, Collybia umbrina*, and *Collybia radicata* var. *pusilla*. It is characterized by a geranium-like odor, a glabrous stipe (Figs. 1a, 2), erect to collapsed thin-walled, hair-like pileocystidia (Figs. 22, 33), cylindrical subcapitate pleurocystidia (Figs. 27-29), prominently capitate cheilocystidia (Figs. 25-26, 30-32), and limoniform to amygdaliform finely roughened spores (Figs. 23-24, 37-39). In North America this is the only species which develops orange lamellae when dried and stored with napthalene. The rare *Xerula rugosoceps*, like *X. radicata* var. *radicata*, has ventricose, obtuse pleurocystidia, and a nonstratified lamellar trama, but is distinguished by smaller spores and a prominently rugose-plicate pileus. One species found in Canada was undescribed. *Xerula rubrobrunnescens* sp. nov. is characterized by reddish brown staining of the stipe and lamellae (Figs. 4-5), gelatinized laterostrata of the lamellar trama (Figs. 40, 43), fusoid pleurocystidia with acute to capitate apices (Figs. 41, 43, 45), ventricose cheilocystidia (Figs. 42, 46), and limoniform to amygdaliform finely roughened spores (Figs. 44, 50-51). There are no pileocystidia.

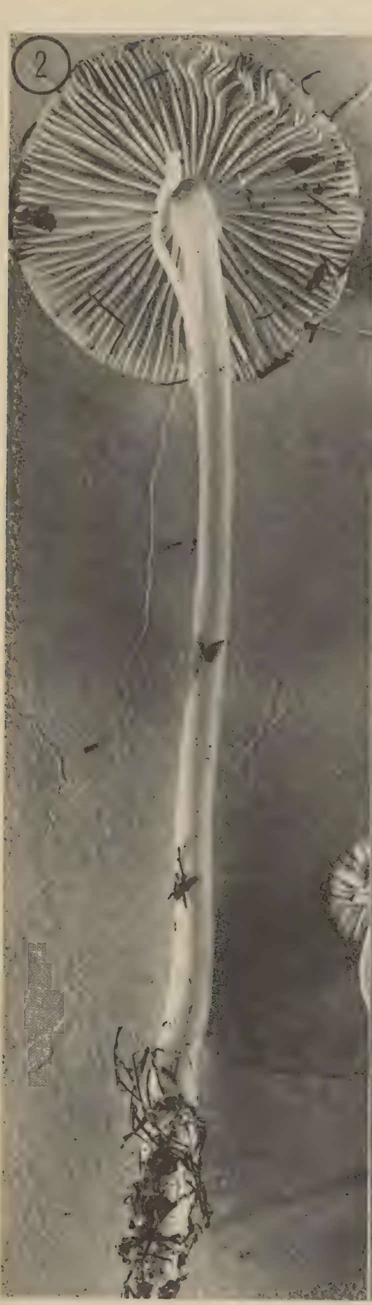
Among both European and U.S.A. collections representing *Xerula radicata*, there were both 4-spored forms and 2-(3-)spored forms. The latter lacked clamp connections and had correspondingly larger spores. Both varieties differed from variety *furfuracea* by the lack of pileocystidia and by much smaller, less abundant and less well formed, nonprojecting caulocystidia (Fig. 14), and hence have essentially glabrous stipes. Three collections from the eastern U.S.A. were tentatively identified as *X. radicata* var. *africana* Dorfelt. One other North American collection from Pennsylvania was identified as *Xerula americana* Dorfelt.

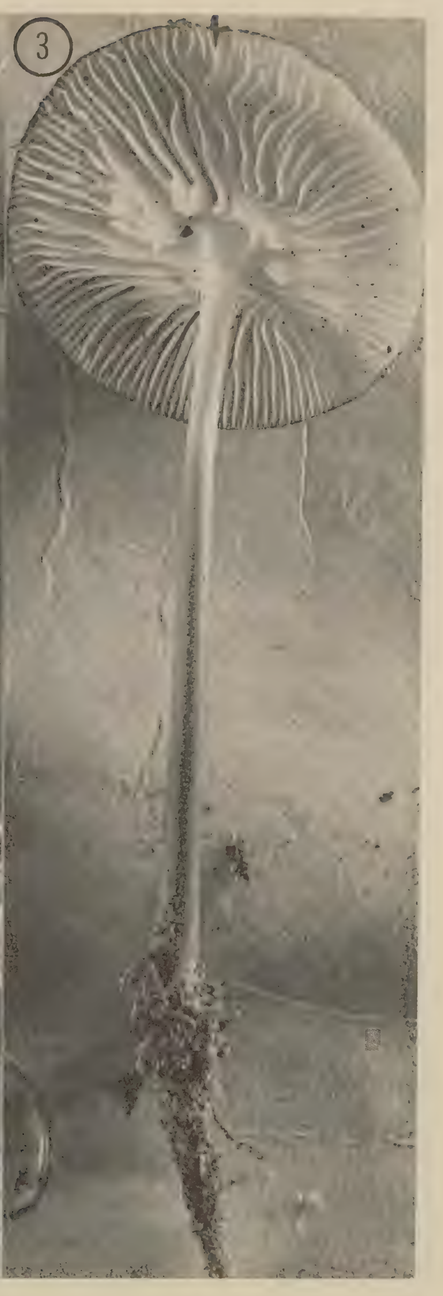
The culture, DAOM 180395, reported from Manitoba as *X. americana* Dörfelt by Dörfelt (1986) is a species of *Flammulina* closely allied to *F. fennae* Bas (1983). *Agaricus texensis* is a synonym of *Flammulina velutipes* (Curt.: Fr.) Singer.

KEY TO *XERULA* SPECIES IN NORTH AMERICA

1. Pileipellis dry, not gelatinizing, covered by abundant hyaline, setiform pileocystidia (sect. *Xerula*) .... *X. americana*
1. Pileipellis gelatinizing, lacking hairs or bearing scattered thin or thick-walled hairs mainly concentrated on the disc or margin at maturity (sect. *Radicatae*) 2
    2. Lamellar trama stratose, the lateral strata gelatinized; lacking pileocystidia (hairs); pleurocystidia fusoid, acute to capitate; epigeous and hypogeous portions of stipe and lamellae staining reddish brown when handled .... *X. rubrobrunnescens*

Fig. 2. *Xerula megalospora*, reverse of fig. 1a. Fig. 3. *Xerula furfuracea*, reverse of fig. 1b. Both slightly larger than Fig. 1.


2


3

2. Lamellar trama not stratose, not gelatinized; with or without thin or thick-walled pileocystidia (hairs) concentrated on the disc or marginal regions; pleurocystidia cylindrical; epigeous portions not staining 3

3. Cheilocystidia capitate, not seated on a gelatinized margin; pleurocystidia subcapitate; caulocystidia rare, solitary and confined to the extreme apex; pileocystidia hair-like, thin-walled; basidiospores limoniform to amygdaliform, finely roughened (LM); lamellae becoming bright orange on dried herbarium materials (after about 1 yr. exposure to napthalene) .... *X. megalospora*

3. Cheilocystidia fusoid to ventricose, seated on a gelatinized margin; pleurocystidia ventricose or truncated; pileocystidia either lacking or when present subsetiform, thick-walled at maturity; basidiospores ellipsoid, ovoid, or sublimoniform, smooth (LM); lamellae not becoming orange on dried herbarium materials 4

4. Stipe furfuraceous to pubescent; erect caulocystidia abundant over the entire surface, often fasciculated; thick-walled subsetiform pileocystidia concentrated on the disc region; pleurocystidia utriform and often truncated; basidiospores 14-16 (-17) x 9.5-11 (-12) µm, ovoid to ellipsoid; common in eastern North America .... *X. furfuracea*

4. Stipe glabrous; lacking projecting caulocystidia; lacking pileocystidia; pleurocystidia ventricose with broadly rounded apices; basidiospores variable 5

5. Clamp connections absent; basidia 2-spored; basidiospores 21-23 x 14-16 µm, sublimoniform; in North America known only from the U.S.A. .... *X. radicata* var. *bispora*

5. Clamp connections present; basidia 4-spored; basidiospores variable 6

6. Basidiospores sublimoniform, 19.5-24 x 12-15.5 µm; in North America known only from the U.S.A. .... *X. radicata* var.?*africana*

6. Basidiospores smaller, ellipsoid to ovoid 7

7. Basidiospores 15-18.5 x 10-11(-12) µm; pileus smooth to rugose but not prominently rivulose ridged; in North America known only from the U.S.A. .... *X. radicata* var. *radicata*

7. Basidiospores 9.5-13.5 x 7-9.5 µm; pileus prominently rivulose ridged, the pileipellis plicate at the ridges .... *X. rugosoceps*

TAXONOMIC PORTION

Xerula furfuracea (Peck) Redhead, Ginns & Shoemaker, stat. et comb. nov.

= *Collybia radicata* var. *furfuracea* Peck, Report N.Y. State Mus. 45 (Bot. Ed.): 31 (Mus. Ed. p. 91). 1892.

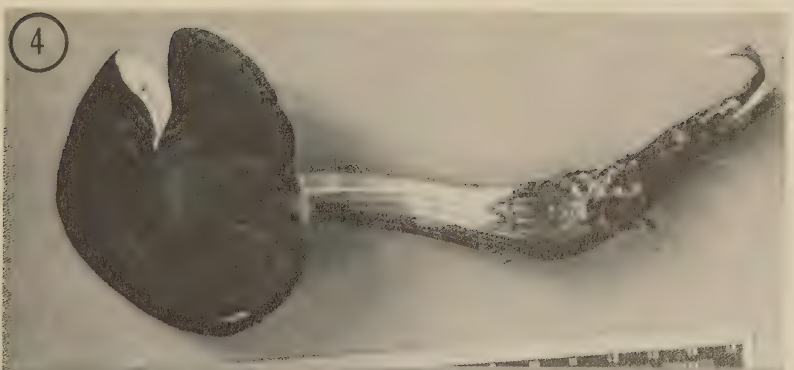
Figs. 1b & c, 3, 6-13, 15-21, 70-71

Pilei 18-120 mm wide, convex to plano-convex, usually with a smooth, pronounced bullate umbo, initially dry and slightly velvety, soon moist or lubricous in wet weather, drying and becoming rimose

---

Figs. 4-5. *Xerula rubrobrunnescens*, DAOM 196931, ca. half size, note stained stipe where handled. Fig. 6. *Xerula furfuracea*, DAOM 196108, lamellar edge in section, note gelatinized swollen form, ca. 120 X.

④



⑤

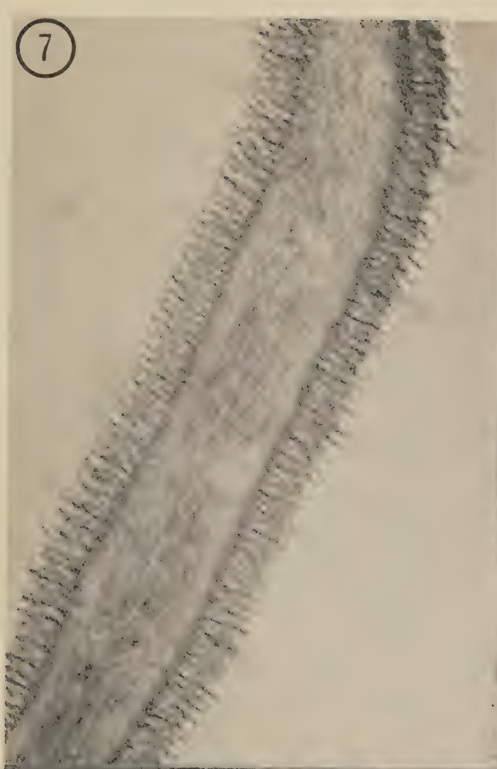
⑥

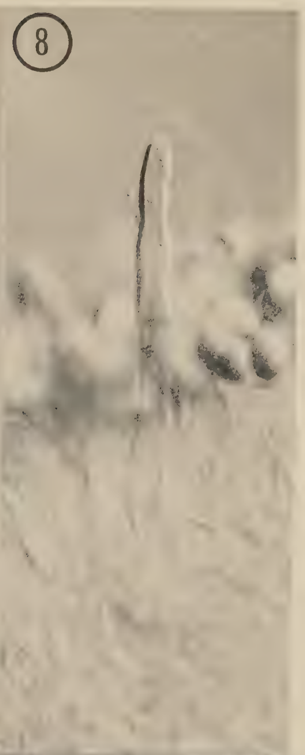
marginally in dry weather, entirely opaque or translucent on the marginal few mm when moist, moderately to strongly rugose or puckered around the umbo or disc area, otherwise smooth or somewhat corrugate-striate marginally, varying in colour from smoky hazel to isabelline, honey or buff coloured centrally and concolorous or paler marginally, occasionally innately streaked with more darkly pigmented streaks; context white, not staining, fleshy; odor and taste not distinctive. Lamellae broadly adnate or uncinate, broadly ventricose at maturity, readily seceding, whitish, sometimes entirely or partially marginate with hazel to isabelline colours, subdistant, with 2-3 tiers of lamellulae. Epigeous stipes 70-125 mm long, 1.5-6 mm diam apically, 2-13 mm diam basally, dry, greyish sepia to mouse grey, rarely whitish, furfuraceous, rarely sparsely pubescent (visible with a handlens), often striate, in dry weather sometimes corticate by a finely areolate pigmented sheath, apically powdered and white, sometimes tomentose at the soil-air interface, somewhat cartilaginous, often the outer cortex snapping revealing an extracted white, spongy, inner cylinder; pseudorhizae up to 126 mm long, white, developing cinnamon to rust coloured stains upon handling, tapered below to 1-2 mm diam and attached to dead roots.

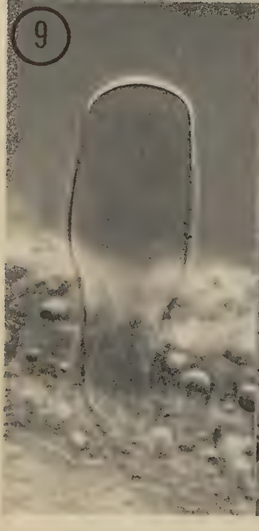
Pileipellis a gelatinized subhymenial layer of clavate to pyriform, ± pedicellate cells 36-55 x 15-22 µm with thin to slightly thickened, smooth, hyaline, walls, basal clamps, usually with fuscous contents, intermingled with scattered deeply rooted, giant cells up to 85 x 35 µm with slightly thickened basal walls, and with scattered pileocystidia mostly concentrated on the disc or marginal regions. Pileocystidia 120-150 x 10-13 µm, at maturity cylindrical with narrowly ventricose bases, and thickened, hyaline walls up to 1.5 µm thick. Subpellis subgelatinized, hyphae 3-5 µm diam., interwoven. Context monomitic, composed of loosely arranged, elongated fusoid cells, mostly up to 20 µm diam, with smooth, thin, hyaline walls. Lamellar trama sarcodimitic, fusoid cells descending, up to 30 µm diam, several 100 µm long, bound by hyphae 4-5 µm diam. Pleurocystidia abundant, scattered, prominently projecting, 110-132 x 24-34 µm, broadly cylindrical with tapered bases and somewhat truncated-rounded apices, slightly and evenly thickened hyaline walls, secreting an oily substance which may become yellowish or yellowish brown in old specimens but does not become orange. Cheilocystidia abundant, formed on a swollen, sterile subgelatinized edge, 55-135 x 14-21 µm, narrowly fusoid to ventricose, ± pedicellate, thin-walled, readily collapsing in dried material, hyaline or with fuscous contents, seated on a gelatinized matrix with hyphae 2-4 (-5) µm diam. Basidia 55-60 x 13-14 µm, clavate, 4-spored, clamped. Basidiospores 14-16 (-17) x 9.5-11 (-12) µm, broadly ovoid to ellipsoid, smooth (LM), hyaline, with slightly thickened, acyanophilous, nonamyloid walls, a prominent apiculus, usually one large guttule. Stipitipellis a loose layer of hyphae 4-6 µm diam bearing fasciculated, abundant caulocystidia. Stipe trama sarcodimitic, fusoid cells parallel, up to 20 µm diam, several 100 µm long, bound by hyphae 4-5 µm diam, walls slightly thickened, smooth, hyaline. Caulocystidia abundant over the entire surface, fasciculated,

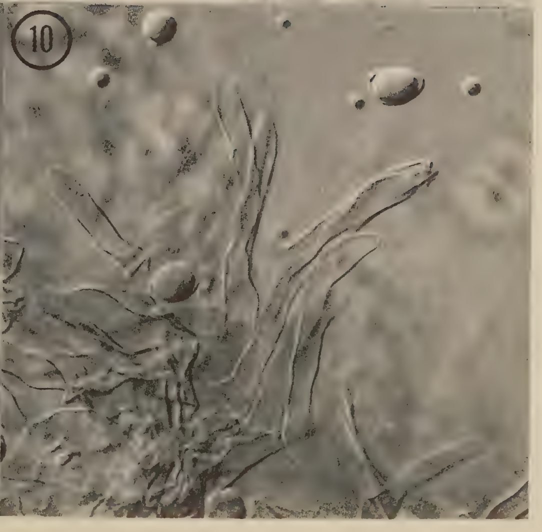
---

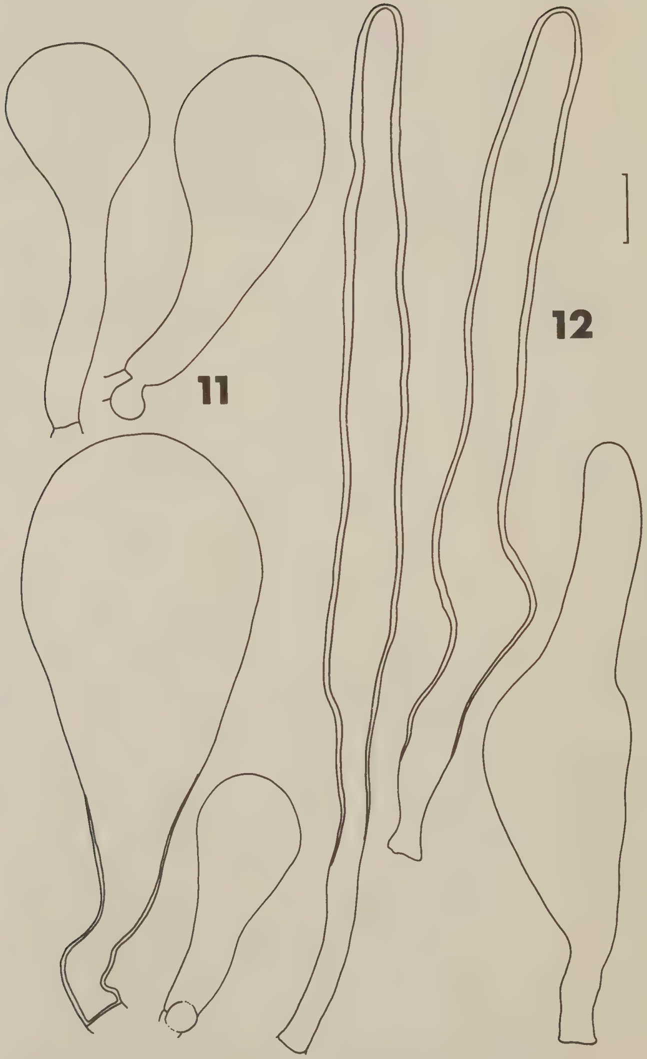
Figs. 7-10. *Xerula furfuracea*. Fig. 7. Cross section of lamellar trama, DAOM 196108, ca. 120 X. Fig. 8. Pileocystidium, DAOM 196107, ca 480 X. Fig. 9. Pleurocystidium, DAOM 196108, ca. 480 X. Fig. 10. Cheilocystidia, DAOM 196107, ca. 480 X.


⑦


⑧


⑨


⑩



Figs. 11-12. *Xerula furfuracea*, DAOM 196108. Fig. 11. Pileipellis elements, including one giant cell. Fig. 12. Pileocystidia. Scale = 10 µm.

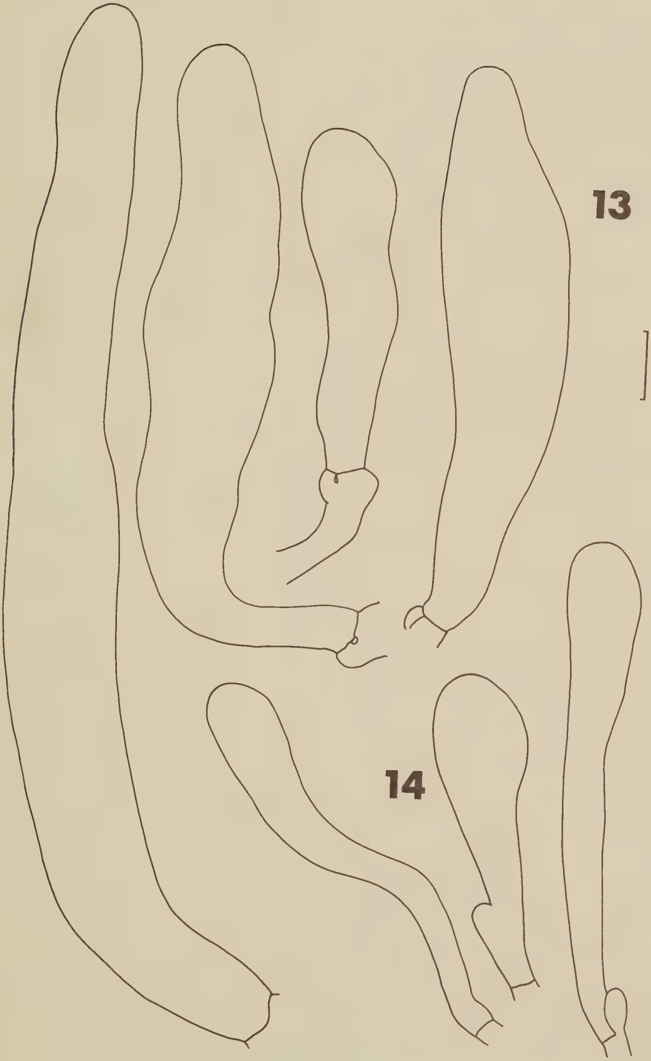
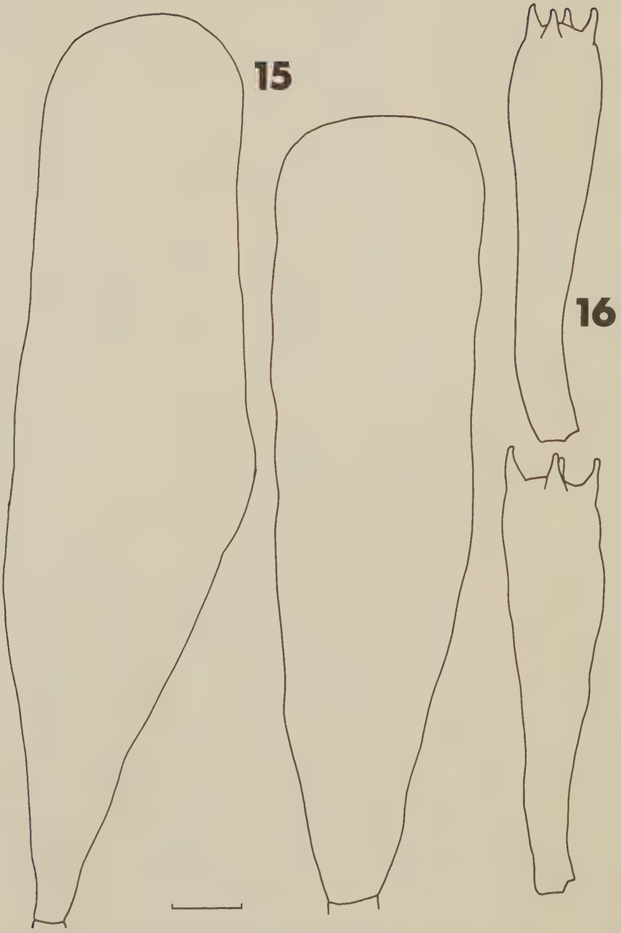


Fig. 13. *Xerula furfuracea*, DAOM 196108, caulocystidia. Fig. 14. *Xerula radicata* var. *bispora*, DAOM 96902, caulocystidia. Scale = 10 µm.



Figs. 15-16. *Xerula furfuracea*, DAOM 196108. Fig. 15. Pleurocystidia. Fig. 16. Basidia. Scale = 10 µm.

17

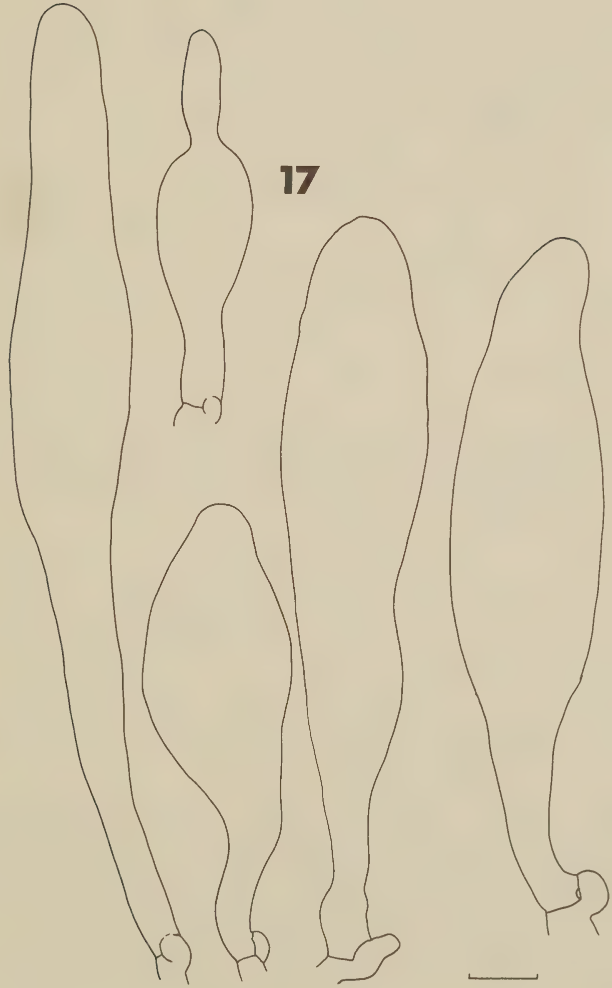
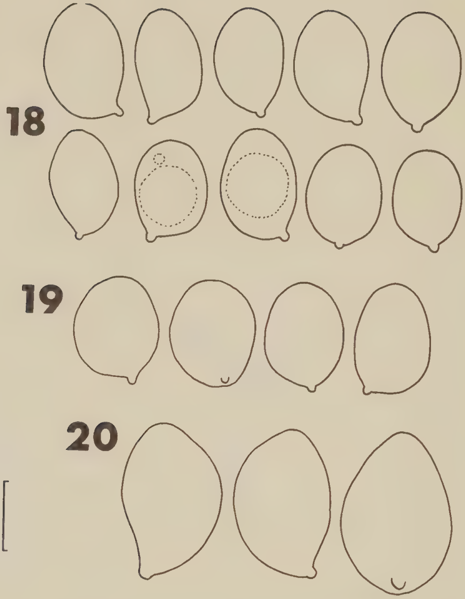


Fig. 17. *Xerula furfuracea*, DAOM 196108, cheilocystidia. Scale = 10 µm.



Figs. 18-19. *Xerula furfuracea* basidiospores. Fig. 18. DAOM 196108. Fig. 19. Type of *Collybia radicata* var. *furfuracea* (NYS). Fig. 20. *Xerula radicata* var. *bispora*, A. J. Stanley, Iowa City, Sept. 27, 1936 (NY). Scale = 10 µm.

50-155 x 13-19 µm, cylindrical to narrowly fusoid or ventricose, thin-walled, smooth, hyaline or with fuscous contents.

Habitat: solitary or gregarious from buried roots of hardwoods (once on *Acer saccharum* Marsh.).

Range: Canada: Nova Scotia, southern Ontario and Québec. U.S.A.: Connecticut, District of Columbia, Indiana, Maine, Massachusetts, Michigan, Missouri, New Hampshire, New York, Ohio, Pennsylvania, Vermont, Virginia, West Virginia.

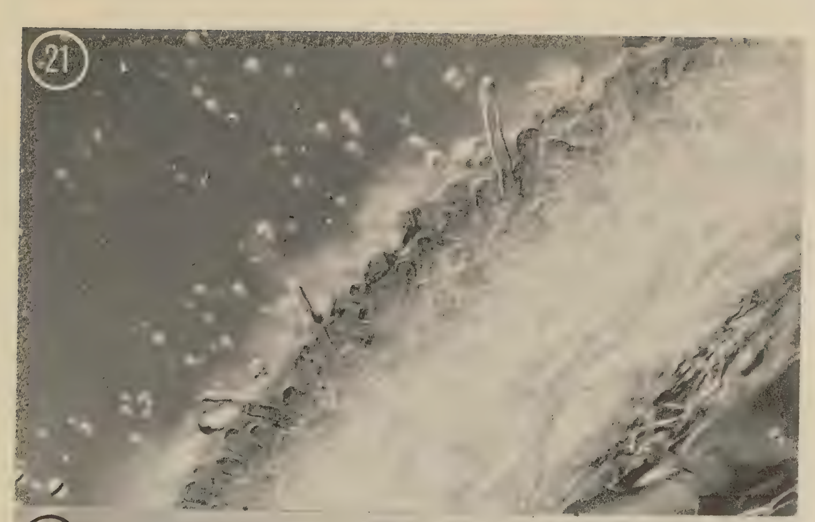
Specimens examined: Canada: Nova Scotia: Cape Breton, Whycocomagh, Sept. 6, 1960, K.A. Harrison (DAOM 71775); Kentville, July 27, 1930, K.A. Harrison (DAOM 110850). Ontario: Algonquin Park, Nightingale Twp., Aug. 3, 1976, P. Johnson (DAOM 186626), Lake Mews, Sept. 14, 1959, R.F. Cain (TRTC 35463); Duferin Co., E of Horning's Mill, July 12, 1970, S. Chopak (TRTC 50980); Haliburton Co., Gulfoot L., Aug. 20, 1952, J.A. Parmelee & W. Cody (DAOM 35224); Kanata, July 27, 1981, K.W. Spicer (DAOM 181100); Lake Timagami, Sept. 8, 1930, H.S. Jackson et al. (TRTC 1856), Aug. 3, 1931, R.F. Cain (DAOM 80342); Muskoka Dist., Dorset, Sept. 9, 1961, J. Hamley (TRTC 50977), Sept. 11, 1961, R.F. Cain (TRTC 37708), Sept. 15, 1963, R.F. Cain (TRTC 40947), Sept. 1, 1982, J.C. Krug 660 (TRTC); Ottawa, July 1920, W.S. Odell (DAOM 39732), Sept. 16, 1902, J. Macoun (DAOM 49730); Peel Co., Palgrave, June 12, 1955, R.F. Cain (TRTC 31735); Petawawa, Sept. 20, 1945, J.W. Groves (DAOM 16437); St. Lawrence Is. Natl. Park: Camelot I., Aug. 10, 1976, E. Kokko (DAOM 154692), Endymion I., Sept. 9, 1976, J. Bissett (DAOM 154690), Grenadier I., July 31, 1975, M. Kaufert (DAOM 153550), Mulcaster I., Oct. 5, 1976, J. Bond (DAOM 159022), Thwartway I., Sept. 23, 1976, H. Thomson (DAOM 159021); Toronto, Aug. 3, 1931, Mr. Crow (TRTC 3895); York Mills, Aug. 2, 1921, H. Haining (TRTC 370). Québec: Berthierville Co., Berthierville, Aug. 4, 1950, R. Pomerleau (QFB 10488), Aug. 20, 1982, Y. Dalpé 95 (DAOM 186975), Ste-Thecle, July 12, 1951, R. Pomerleau (QFB 11591); Burnet, July 17, 1938, F.L. Drayton (DAOM 8641); Chelsea Station, Aug. 31, 1935, I.L. Conners (DAOM F-5661); Dorches Co., St-Prosper, Aug. 12, 1943, R. Pomerleau (QFB 5414); Frontenac Co., Storneway, Aug. 5, 1943, R. Pomerleau (QFB 5364); Gatineau Co., Cantley, St. Elizabeth Rd., Ginns' farm, July 15, 1986, J. Ginns (DAOM 196105, 196106, 196107, 196108); July 16, 1986, J. Ginns (DAOM 196109, 196110, 1196111, 196112, 196114, 196315); Gatineau Park, Aug. 12, 1943, J.W. Groves (DAOM 11410); Ile Jesus, Aug. 26, 1941, E. Groves (DAOM 10584); Kamouraska Co.., Riviere-Ouelle, Oct. 9, 1949, R. Pomerleau (QFB 12016); Levis Co., St-Nicolas, Sept. 7, 1948, R. Pomerleau (QFB 10485); L'Ilet Co., St-Aubert, Aug. 16, 1943, R. Pomerleau (QFB 5469); Lotbinière Co., St-Sylvestre, Aug. 30, 1941, R. Pomerleau (QFB 7353); Mégantic Co., Plessisville, Aug. 3, 1943, R. Pomerleau (QFB 5685); Portneuf Co., Duchesnay, Aug. 24-26, 1938, L.K. & E.S. Henry (NY), J.A. Stevenson (BPI), Aug. 28, 1938, R. Pomerleau (QFB 1397); Québec Co., Pont de Québec, July 22, 1951, R. Pomerleau (QFB 11594); Rouville Co., Mont Yamaska, Frere Fabius (QFB 12372); Shefford Co., Waterloo, Aug. 9, 1943, R. Pomerleau (QFB 5365). U.S.A.: Connecticut: Bolton, July 17, 1903, C.C. Hanmer 1372 (BPI); East Hartford, Aug. 11, 1902, C.C. Hanmer 354 (BPI). District of Columbia: Mt. Pleasant, Aug. 31, 1906, J.E. Wilcox (BPI); Rose Creek Park, Aug. 6, 1917, V.K. Charles (BPI). Indiana: Bloomington, Aug. 23, 1956, M. Elliott & M. Pantidou (DAOM 62876); Portland Arch Nat. Pres. near Fountain, Sept. 19, 1980, I.L. Conners (DAOM 185744); Putnam Co., Greencastle, Oct. 1893, L.M. Underwood (NY). Maine: Bar Harbor, 1901, V. S. White 114 (NY); SE of Millinocket, Aug. 22, 1940, L.K. Henry (NY). Maryland: Prince Georges Co., Beltsville, May 22, 1973, M.L. Farr 4284 (BPI). Massachusetts: Mt. Toby, Aug. 25, 1963, J.W. Groves (DAOM 93221); Petersham, Harvard Forest, Aug. 19, 1949, L.K. Henry (NY). Michigan: Cheboygan Co., Grapevine Point, 1973, M. Koniuchowskyj 9 p.p. (BPI); Chippewa Co., W. of Detour, Aug. 20, 1949, H. Imshaug 3753 (BPI); Colonial Point, Burt L., June 29, 1951, S.C. Hoare (DAOM 26964); Indian River, Aug. 1920, L.K. Henry (NY); Montmorency Co., Sept. 11, 1969, K.H. McKnight 11514 p.p. (BPI); Pellston, July 1, 1981, J.S. Plaskowitz 81070102 (BPI 900650); Sharron Hollow, July 21, 1938, L.K. Henry & A.H. Smith p.p. (NY); Traverse City, July 3, 1933, C.B. Stifler (BPI); Upper Tahquamenon Falls, Aug. 6, 1981, J.S. Plaskowitz 81080604 (BPI 900629); Warrens Woods, Oct. 1938, C.B. Stifler (BPI). Missouri: St. Louis, May & Oct. 1898, N.M. Glatfelter 241 (BPI). New Hampshire: Balch Hill, Aug. 26, 1937, M.B. Knauz (NY); Frenchis Camp Enfield, Sept. 3, 1963, J.A. Stevenson (BPI). New York: Adirondack Park, Lake Placid, July 17-29, 1912, E.. & W.A. Murrill (NY), Upper St. Regis, Aug. 25-31, 1915, W.A. Murrill 105 (NY); Alcove, Aug. 1892, C.L. Shear (BPI); Bolton, Aug. 24, 1901, C.H. Peck (as *Collybia radicata pusilla* Pk., NYS p.p.); Bronx Co., Bronx, Oct. 4, 1983, S. Stein (NY); Cayuga Lake basin, July 22, 1904, H.S. Jackson 1012 (TRTC); Chautauqua Co., June 26, 1908, D.R. Sumstine (NY); Delaware Co., Arkville, Aug. 7-17, 1916, W.A. Murrill (NY); Ithaca, Aug. 1, 1915, J.H. Faull 1023

(TRTC); Lake Pleasant, Aug. (1891 or 1892 according to notes examined by Dr. J.H. Haines), C.H. Peck (as *Collybia radicata* var. *pusilla*, NYS, specimens mounted on cardboard, here excluded from type of *C. radicata* var. *pusilla* = *X. megalospora*); Otsego Co., N. of Oneonta, Sept. 22, 1963, I. Mearns (TRTC 41028); Rockland Co., Sparkill, Aug. 12, 1904, G.A. Reichling 436 (BPI); Sevey, July, C.H. Peck (as *Collybia radicata* var. *furfuracea*, NYS, here selected as LECTOTYPE); S. of Steamburg, June 22, 1940, L.K. Henry (NY); Syracuse, Sept. & Oct. 1888, L.M. Underwood (NY); Tompkins Co., Lower Enfield Glen, Aug. 20, 1935, J.A. Stevenson (BPI). Ohio: Delaware Co., Sept. 2, 1968, M.E. Elliott (DAOM 127142); Huron Co., Olena, July 20, 1905, O.E. Jennings (NY); Oberlin, Sept. 1894, F D. Kelsey (BPI). Pennsylvania: Allegeheny Co., S. of Smithdale, June 1927, L.K. Henry (NY); Armstrong Co., Kittanning, Sept. 1901, D.R. Sumstine (NY); Beaver Co., Temple Hollow, N.W. of Alliquippa, June 30, 1938, L.K. Henry (NY); Bradford Co., SW of Laguin, Aug. 24, 1941, L.K. Henry (NY); Butler Co., Uplands, July 6, 1937, L.K. Henry (NY); Cambria Co., June 27, 1939, D.R. Sumstine (NY); Cameron Co., NE of Sinnemakoning, Aug. 15, 1937, L.K. Henry (NY); Centre Co., NW of State College, Aug. 15, 1942, L.K. Henry (NY), near Shingle Town, Aug. 1, 1930, C.S. Parker 1794 (BPI); Clarion Co., Sept. 18, 1940, D.R. Sumstine (NY); Clearfield Co., NW Girard Twp., Aug. 20, 1941, L.K. Henry (NY); Crawford Co., near Cochranton, Aug. 25, 1935, H.S.W. (NY); Elk Co., E of Medix Run, Aug. 15, 1937, L.K. Henry (NY); Erie Co., SW of Erie, Aug. 18, 1931, O.E. Jennings (NY); Fayette Co.: Ohio Pyle, Sept. 16, 1906, D.R. Sumstine (NY); Forest Co., NW of Brookston, July 24, 1940, L.K. Henry (NY); Huntington Co., NW of Saltillo, Sept. 10, 1950, D.E. Long (NY); Indiana Co., near Glen Campbell, Aug. 4, 1938, L.K. Henry (NY); Jefferson Co., NE of Sigel, Aug. 11, 1949, L.K. Henry (NY); Lawrence Co., Muddy Creek Falls, Oct. 7, 1937, L.K. Henry (NY); McKean Co., near Cyclone, 1937, O.E. & G.K. Jennings (NY); Mercer Co., Sandy L., June 30, 1935, L.K. Henry (NY); Potter Co., NE of Austin, Aug. 15, 1937, L.K. Henry (NY); Somerset Co., NW of Trent, July 7, 1949, L.K. Henry (NY); Venango Co., NE of Lisbon, Sept. 19, 1936, L.K. Henry (NY); Warren Co., Sept. 17, 1947, L.K. Henry (NY); Washington Co., near New Eagle, July 9, 1942, L.K. Henry (NY); Westmoreland Co., SE of Rector, July, 1958, L.K. Henry (NY). Vermont: Middlebury, Aug. 14, 1897, E.A. Burt (BPI). Virginia: Arlington Co., Westover, April 24, 1965, J.A. Stevenson (BPI); Frederick Co., E. of Middletown, Aug. 26, 1978, B. Legge (BPI); White Post, Sept. 16, 1911, ? Murrill (NY). West Virginia: Tomlinson Run State Park near Pughtown, Aug. 4, 1937, L.K. Henry (NY).

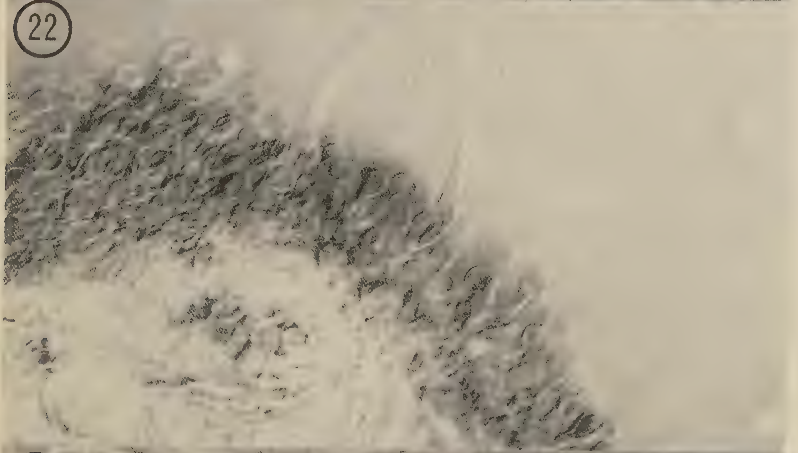
The continued recognition of *Xerula furfuracea* at the varietal level is based on a misunderstanding by Peck and lack of detailed studies since Peck's time. Peck (1892) recognized two forms of *Collybia radicata* sensu lato in eastern North America. He believed that the form with a glabrous stipe represented the type variety because European accounts of *C. radicata* described the stipe as glabrous. The second form had a furfuraceous stipe, hence the name *Collybia radicata* var. *furfuracea*. In fact the commonest North

---

Fig. 21. *Xerula furfuracea*, DAOM 196107, pileipellis, note pileocystidia, ca. 190 X. Figs. 22-24. *Xerula megalospora*. Fig. 22. Pileipellis, note pileocystidium, ca. 190 X. Fig. 23. Basidiospores, DAOM 196116, ca. 1200 X. Fig. 24. Basidiospores, DAOM 196316, note fine roughening, ca. 1200 X.



21



22

23

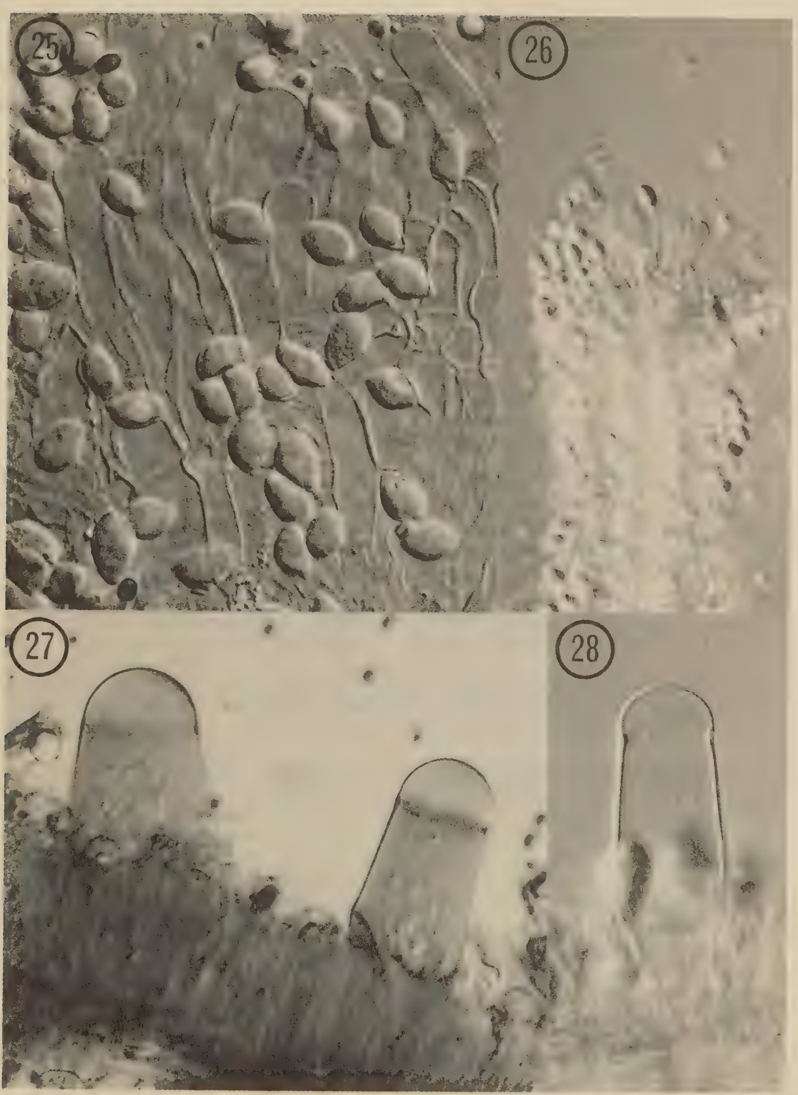
24

American form with a glabrous stipe is *X. megalospora*. It differs from *X. radicata* by several features (spore size, shape and roughening, pleurocystidial form, cheilocystidial form, presence of orange necropigment, pileocystidia, lack of caulocystidia with few exceptions, odor) *Xerula radicata* var. *radicata* does occur in the U.S. but is rare. *X. furfuracea* has more abundant, often pigmented, protruding caulocystidia which are approximately three times larger than those in *X. radicata* (cf. Fig. 13 to 14), and it produces thick-walled pileocystidia (Figs. 8, 12, 21) which are totally absent in *X. radicata*. Furthermore, although present as *Oudemansiella radicata* var. *furfuracea* in the recent key to *Oudemansiella* by Pegler and Young (1987), the *X. furfuracea* cannot be keyed out there because the combination of distinct dermatocystidia (pileocystidia) and a gelatinized pileipellis is not recognized in the key to sections. For these reasons we recognize *X. furfuracea* as a distinct North American species.

Xerula megalospora (Clements in Clements & Pound) Redhead, Ginns, & Shoemaker, comb. nov.
= *Clitocybe megalospora* Clements in Clements & Pound, Bot. Survey Nebraska 4: 18. 1896.
= *Collybia umbrina* Clements in Clements & Pound, Bot. Survey Nebraska 4: 19. 1896.
= *Collybia radicata* var. *pusilla* Peck nom. prov., Report N.Y. State Mus. 45 (Bot. Ed.): 31 (Mus. Ed. p. 91). 1892.
= *Collybia radicata* var. *pusilla* Peck, Report N.Y. State Mus. 49 (Bot. Ed.): 35 (Mus. Ed. p. 49). 1896.
= *Collybia radicata* var. *minor* Peck, nom. herb.
Figs. 1a, 2, 22-39, 72

Pilei 21-82 mm wide, broadly conical becoming convex to plane and slightly depressed or shallowly bullate centrally, viscid in wet weather, dry and subpolished in dry weather, often corrugate-striate marginally, smooth centrally with a surrounding zone smooth or radially, moderately to strongly rugose, varying in colour from smokey hazel or greyish sepia to buff centrally to buff or white marginally, more often rather pale than dark, the edge sometimes scalloped; context white, not staining, fleshy; taste not distinctive; odor strongly or faintly of geraniums or carrots. Lamellae broadly adnate to uncinate, broadly ventricose at maturity, white, distant to subdistant, 2-4 tiers of lamellulae, not readily seceding except in over mature specimens. Epigeous stipes 60-130 mm long, 2-6 mm diam apically, 3-10 mm diam below, white, dry, glabrous, often silky and finely striate, sometimes slightly twisted, not staining; pseudorhizae up to 80 mm long, white, staining cinnamon to rust coloured upon handling, tapered below to 1-2 mm diam and attached to dead roots.

Pileipellis a gelatinized, subhymenial layer of clavate to pyriform, occasionally subglobose, ± pedicellate cells, 35-47 x 16-18 (-32) µm, with or without fuscous contents, with smooth, thin or only slightly thickened walls and basal clamps, intermingled with scattered hair-like cystidia, mostly concentrated in the disc region. Pileocystidia up to 300 µm long, with ventricose bases 10-13 µm diam, necks 3-4 µm diam, thin-walled, aseptate, often collapsed in mounts. Subpellis subgelatinized, hyphae 3-7 µm diam, interwoven. Context monomitic, composed of loosely arranged, long, fusoid cells mostly



Figs. 25-28. *Xerula megalospora*. Fig. 25. Cheilocystidia and basidiospores, DAOM 196115, note capitate heads, ca. 480 X. Fig. 26. Cheilocystidia, DAOM 196116, ca. 190 X. Fig. 27. Pleurocystidia in congo red, DAOM 196116, note differential staining, ca. 480 X. Fig. 28. Pleurocystidium, DAOM 196116, note unstained walls, cf. fig. 27, ca. 480 X.

8-20 µm diam, with smooth, thin, hyaline walls. Lamellar trama sarcodimitic, fusoid cells descending, 20-24 µm diam, several 100 µm long, bound by hyphae mostly 2-4 µm diam, smooth, hyaline, thin walls. Pleurocystidia abundant, scattered, prominently projecting, 115-135 x 26-34 µm when mature, with a cylindrical body, a pedicellate or tapered base, an apical ring shaped wall thickening which takes up Congo Red intensely, and a subcapitate bubble-like apex less intensely staining in Congo Red than the wall of the body; exuding an oily secretion which, in specimens stored with napthalene, becomes orange. Cheilocystidia abundant, forming a sterile margin, cylindrical to narrowly ventricose and conspicuously capitate, 90-120 x 10-22 x 11-22 µm, mostly with evenly thin or slightly thickened, smooth, hyaline walls, occasionally with a ring shaped wall thickening delimiting the capitulum; secretory like the pleurocystidia. Basidia 50-65 x 15-20 µm, clavate, 4-spored, clamped. Basidiospores 18-23 x 10-14 µm, limoniform to amygdaliform, with thin to slightly thickened, acyanophilous, nonamyloid, hyaline, finely roughened (LM) walls, a prominent apiculus, usually with one large guttule and many smaller guttules with orange necropigment in herbarium specimens. Stipitipellis a loose layer of hyphae 3-7 µm diam, with smooth, thin walls, often with tapered apices, rarely bearing scattered caulocystidia at the extreme apex of the stipe. Stipe trama sarcodimitic, the fusoid cells parallel, up to 20 µm diam, several 100 µm long, bound by hyphae mostly 2-4 µm diam, with smooth, hyaline, thin to slightly thickened walls. Caulocystidia rare, confined to the apex, one measured 135 x 41 µm, saccate-pedicellate, hyaline, smooth.

Habitat: solitary to gregarious from buried roots (*Ostrya virginiana* (Mill.) K. Koch in one case) in hardwood forests.

Range: Canada: southern Ontario and Québec. U.S.A.: Alabama, District of Columbia, Indiana, Louisiana, Maryland, Michigan, eastern Nebraska, New York, Pennsylvania, Tennessee, Virginia, West Virginia, Wisconsin.

Specimens examined: Canada: Ontario: Belleville, Sept. 15, 1878, J. Macoun 18 (DAOM 49731); Brant Co., New Durham, Oct. 9, 1932, R.F. Cain (TRTC 3898); Dufferin Co., E of Horning's Mill, July 12, 1970, S. Chopak (TRTC 46093); Fitzroy Harbour, 1951, R. Mackay (DAOM 26627); Kanata, July 27, 1981, K. Spicer (DAOM 181123); Kinburn, July 6, 1952, J.W. Groves (DAOM 28811); Lake Opinicon, Sept. 8, 1950, E. Groves (DAOM 24251); btw. London & Port Stanley, 5th concession line, Oct. 23, 1926, J. Dearness (herb. Dearness, DAOM); Muskoka Dist., Dorset, Sept. 9, 1961, J. Hamley (TRTC 50979); Nepean, Aug. 29, 1984, Y. Dalpé 1035 (DAOM 190701), July 18, 1986, S.A. Redhead 5198 (DAOM 195906), Aug. 19, 1986, S.A. Redhead 5233 (DAOM 195990); Ottawa, Sept. 24, 1891, J. Macoun 60 (as *Collybia radicata* var. *minor* Peck, nom. herb., NYS), July 27, 1920, W.S. Odell (DAOM 49733), Aug. 3, 1934, I.L. Conners (DAOM 49734), Sept. 5, 1936, J.W. Groves (DAOM F6984), Aug. 20, 1937, J.W. Groves (DAOM F7511), June 29, 1945, O. Prodan (DAOM 16406), June 17, 1951, J.W. Groves (DAOM 27484), July 1973, L.T. Gowans & D. Malloch (DAOM 151161); Petawawa, Sept. 3, 1943, E. & J.W. Groves (DAOM 11486); St. Lawrence Is. Natl. Park, Lindsey I., July 27, 1976, J. Bond (DAOM 154691), Mulcaster I., July 23, 1975, M. McCauley (DAOM 153551); Waterloo, Oct. 1913, Mrs. Dearness (herb. Dearness, DAOM). Québec: Gatineau Co., Cantley, July 22, 1970, J. Ginns 1426 (DAOM 130915), Aug. 21, 1972, J. Ginns 2157 & D. Malloch (DAOM 144172), June 16, 1979, J. Ginns (DAOM 172151), June 24, 1979, S.A. Redhead 3489, 3491 & J. Ginns

29

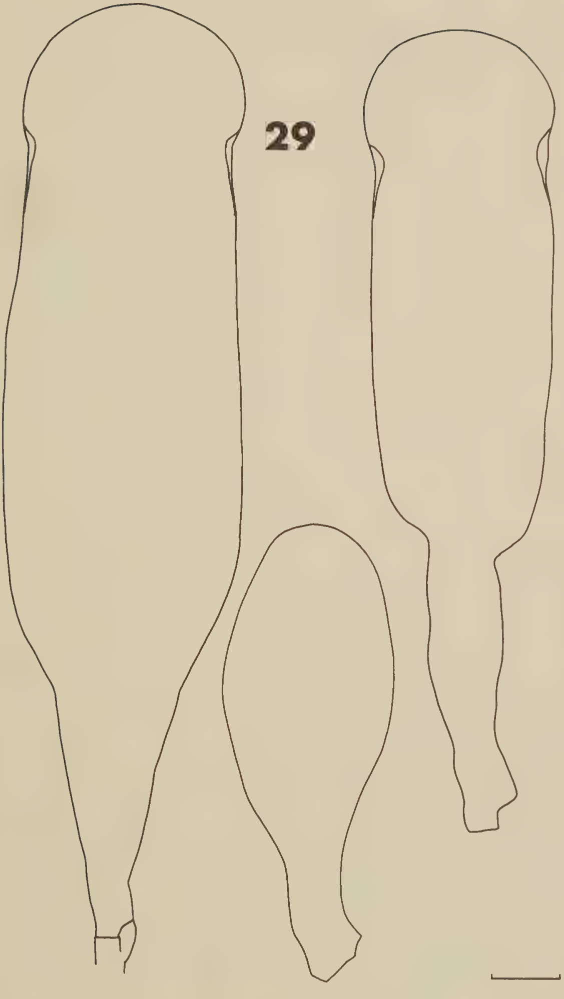
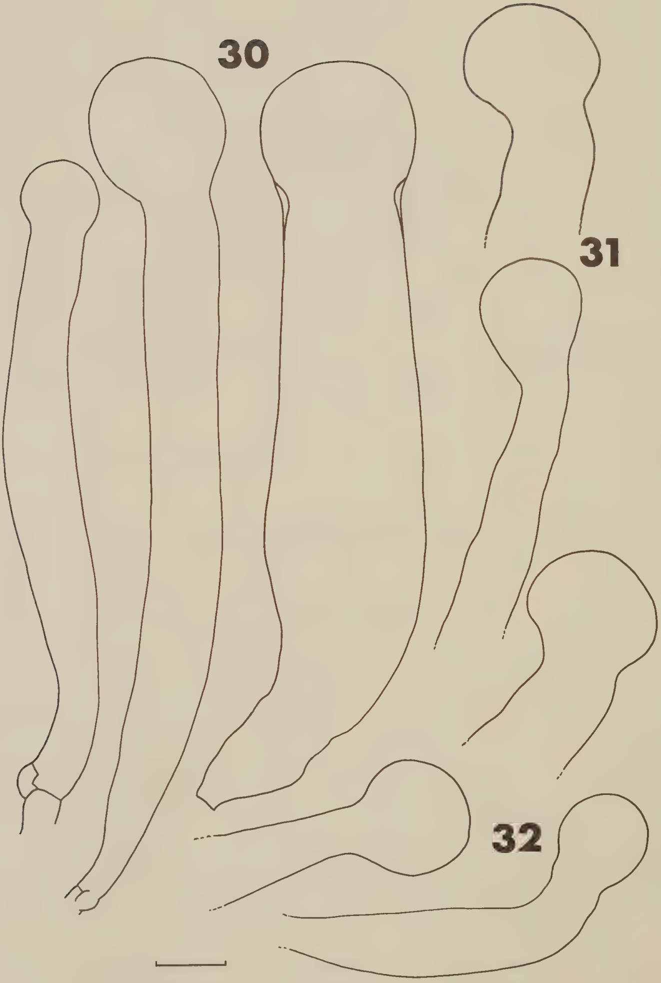
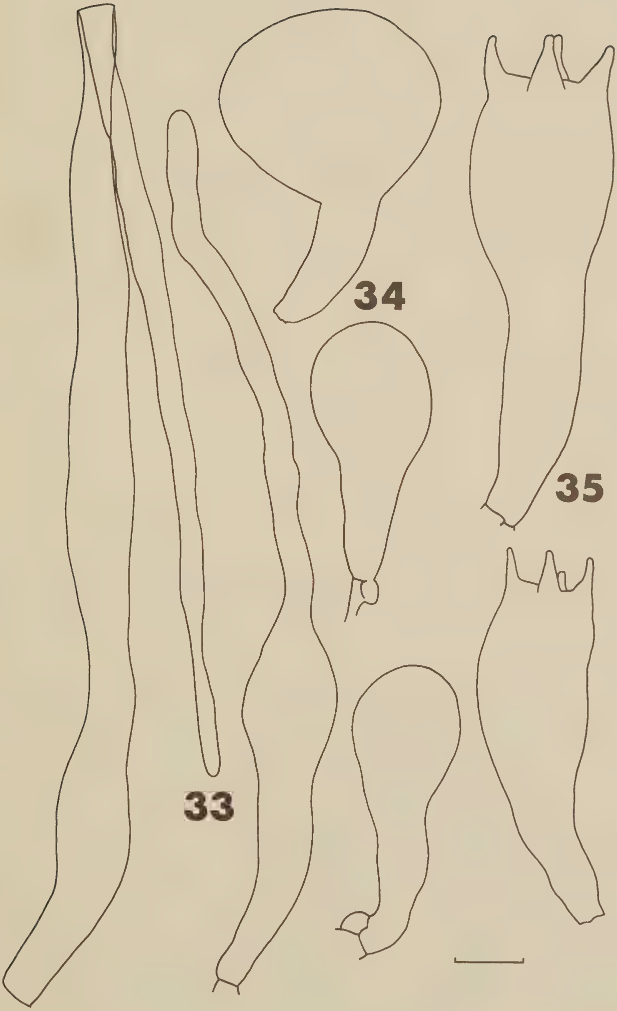


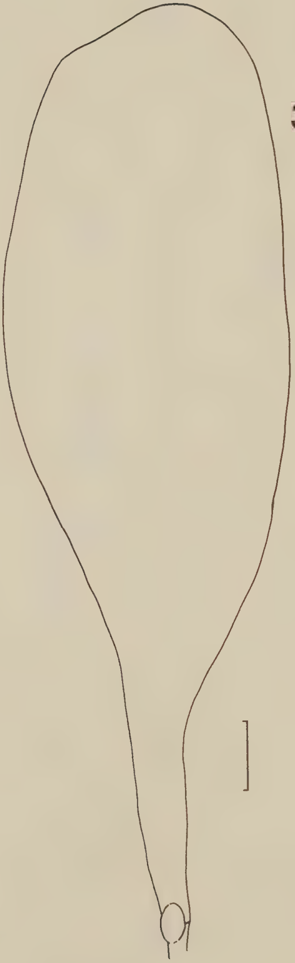
Fig. 29. *Xerula megalospora*, DAOM 196116, pleurocystidia. Scale = 10 µm.



Figs. 30-32. *Xerula megalospora*, cheilocystidia. Fig. 30. DAOM 196116. Fig. 31. Type of *Clitocybe megalospora* (slide in NY prepared by Murrill). Fig. 32. Type of *Collybia umbrina* (NEB), three lower right heads. Scale = 10 µm.

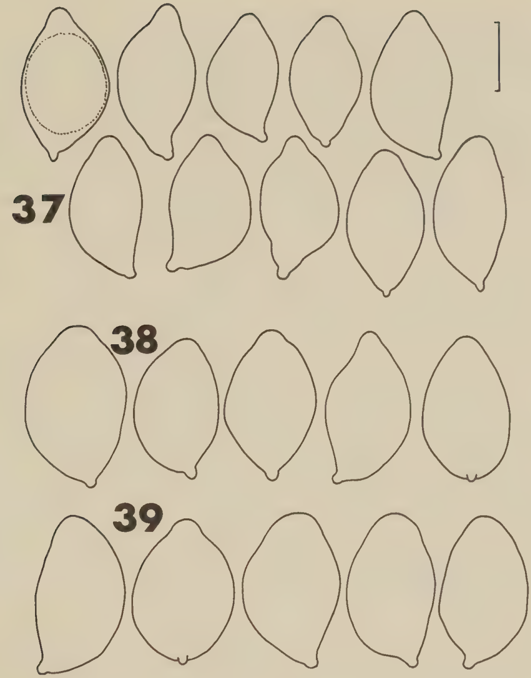


Figs. 33-35. *Xerula megalospora*, DAOM 196116. Fig. 33. Pileocystidia. Fig. 34. Pileipellis elements. Fig. 35. Basidia. Scale = 10 µm.



36

Fig. 36. *Xerula megalospora*, DAOM 196116, caulocystidium. Scale = 10 µm.



Figs. 37-39. *Xerula megalospora* basidiospores. Fig. 37. DAOM 196116. Fig. 38. Type of *Collybia umbrina* (NEB). Fig. 39. Type of *Clitocybe megalospora* (NY). Scale = 10 µm.

(DAOM 175245, 175250), July 15, 1986, J. Ginns (DAOM 196115), July 16, 1986, J. Ginns (DAOM 196116, 196130, 196316); Gatineau Park, Sept. 12, 1942, I.L. Conners (DAOM 196994); Joliette Co., Joliette, Aug. 13, 1951, R. Pomerleau (QFB 11585); L'Ilet Co., St. Aubert, Sept. 17, 1946, J.W. Groves (DAOM 16925); Montcalm Co., St-Alexis, July 4, 1948, R. Pomerleau (QFB 12018); Québec Co., Québec, July 8, 1951, L. Morin (QFB 11593), June 27, 1959, R. Cauchon (QFB 3479). U.S.A.: Alabama: Montgomery, no date, R.P. Burke (NY); Tuscaloosa, May 1896, L.M. Underwood (NY). District of Columbia: Beltsville, Sept. 10, 1926, H.M. Daly (BPI); Washington, July 14-15, 1905, W.A. Murrill (NY), July 23-24, 1917, J. N. Rose (BPI). Indiana: Bloomington, Aug. 22, 1958, M. Elliott (DAOM 62863); Putnam Co., Greencastle, Sept. 1891 & Oct. 1893, L.M. Underwood (NY). Louisiana: St. Martins, Jan. 27, 1890, Rev. A.B. Langlois (BPI). Maryland: Montgomery Co., Valley Mill, June 16, 1969, K.H. McKnight & R.W. Taylor 11285 (BPI). Michigan: Cadillac, July 1912, H.D. House (NY); Cheyboygan Co., Grapevine Point, 1973, M. Koniuchowskyj 9 p.p. (BPI); Maple River, July 6, 1953, S.C. Hoare (DAOM 40216); Sharron Hollow, July 21, 1938, L.K. Henry & A.H. Smith p.p. (NY). Nebraska: Bellevue, July 4, 1894 or 1895, Pound & Clements 4233 (HOLOTYPE of *Collybia umbrina*, NEB); Saltillo, July 7, 1894 or 1895, Pound & Clements 4239 (slide from HOLOTYPE of *Clitocybe megalospora*, NY). New York: Bolton, Aug. 24, 1901, C.H. Peck (as *Collybia radicata pusilla* Pk., NYS p.p.); Cazenovia, July 1889, L.M. Underwood (NY); Lake Pleasant, Aug. (1891 or 1892 according to notes examined by Dr. J.H. Haines), C.H. Peck (as *Collybia radicata* Rehl. var. *pusilla* Pk., NYS, unmounted portion here selected as LECTOTYPE). Pennsylvania: Allegheny Co., SE of Bakerstown, Aug. 8, 1945, L.K. Henry (NY); Armstrong Co., N of Leechburg, June 17, 1953, L.K. Henry p.p. (NY); Beaver Co., W of Aliquippa, July 13, 1937, L.K. Henry (NY); Bedford Co., Sulphur Springs, Aug. 7, 1940, D.R. Sumstine (NY); Butler Co., NE of Harmony, Aug. 4, 1941, L.K. Henry (NY); Clearfield Co., Sept. 23, 1947, L.K. Henry p.p. (NY); Crawford Co., Conneault Park, July 17, 1906, D.R. Sumstine (NY); Erie Co., Waterford, July 18, 1953, L.K. Henry (NY); Fayette Co., Ohio Pyle, along Youghigheny R., July 3-8, 1905, W.A. Murrill (NY); Indiana Co., N of Creekside, July 15, 1953, L.K. Henry, p.p. (NY): Somerset Co., Haines-Saurel Hill, July 8, 1906, D.R. Sumstine (NY); Warren Co., E of Columbus, Sept. 16, 1947, L.K. Henry p.p. (NY); Washington Co., Murdocksville, June 3, 1942, L.K. Henry (NY); Westmoreland Co., Idlewild, June 10, 1942, D.R. Sumstine (NY). Tennessee: Unaka Springs, Aug. 18-24, 1904, W.A. Murrill 722 & 751 (NY). Virginia: Blacksburg, Oct. 23, 1983, R. Vilgalys 83/225 (BPI 900384); Crabottom, July 17-21, 1904, W.A. Murrill 197, 249 (NY); Montgomery Co., Luster's Gate, Aug. 26, 1982, R. Vilgalys 82/292 (BPI 900770); Mountain Lake, July 8-14, 1909, W.A. Murrill 213 (NY). West Virginia: Hancock Co., Rock Springs, June 16, 1906, D.R. Sumstine (NY). Wisconsin: Wychwood, Lake Geneva, July 30, 1932 & Sept. 5, 1938, C.B. Stifler (BPI).

For nearly 100 years the confusion between *Xerula megalospora* and *X. furfuracea* and between *X. megalospora* and *X. radicata* has been perpetuated by the lack of detailed studies. Peck (1892) confused *X. megalospora* with *X. radicata* var. *radicata*. Clements (Clements and Pound 1896) described *X. megalospora* twice, once as a *Clitocybe*, and once as a *Collybia* allied to *C. radicata*. Murrill (1915) obtained the type of *Clitocybe megalospora*, noted its relationship to *C. radicata*, and drew attention to the unusual orange necropigment in the type and other collections he examined. However, Murrill must have had some doubts about the distinctiveness of the species because he placed *Clitocybe megalospora* in synonymy with *Gymnopus radicata* (Rehlan: Fr.) Murrill in North American Flora (Murrill 1916). In the 1950's the presence of the necropigment again commanded attention, but a revision of the complex was not attempted at that time. Hesler (1951) reported that half his collections of "*Collybia radicata*" developed orange lamellae while in the herbarium. Results of matings tests and detailed anatomical studies now supply us with a wealth of distinguishing features. The orange pigment is the most conspicuous feature but is not totally reliable. Thus far it has only been demonstrated in herbarium specimens where napthalene is used, it takes nearly a year to develop, and after approximately 50 years fades to a yellowish colour. A few older specimens noted to be orange in the 1950's have now faded. Lamellae of *X. furfuracea* darken with age in the herbarium and also become yellowish so that the lamellae of both species in very recent collections or in very old collections may be concolorous.

The names *Clitocybe megalospora* and *Collybia umbrina* were published simultaneously and therefore there is a choice of names for this species. Although the bulk of the type for *Clitocybe megalospora* could not be located, the published notes by Murrill (1915), and the slide he prepared from the type (Figs. 31, 39) at the New York Botanical Garden (NY) leave no doubt which species is represented. A specimen of *Collybia umbrina* exists in Nebraska (NEB), however it represents an extremely dark, and rarely collected form of the species (Figs. 32, 38), hence the epithet *umbrina*. The epithet *megalospora* is a more appropriate descriptive term and for this reason it is chosen here. Neither specimen appears orangish macroscopically today, but orangish pigments are present in minute quantities as viewed microscopically.

Peck (1892) tentatively recognized a small form of *Collybia radicata* using the provisional name var. *pusilla*. Three years later he formally used the name (Peck 1896). Two Peck collections at Albany (NYS) are labelled *Collybia radicata* var. *pusilla*, and a third is labelled *Collybia radicata* var. *minor*. The latter is an unpublished name. The specimen, from Ottawa, represents *X. megalospora*. The two collection packets labelled var. *pusilla* contain both *X. megalospora* and *X. furfuracea*. The unmounted portion of the earlier collection (1891 or 1892 according to notes consulted by Dr. J. Haines) is here selected as lectotype. Most small specimens in section *Radicatae* seen by us represent *X. megalospora*.

Herbarium specimens of two other described taxa become orange with time. Berkeley (1845) described *Agaricus radicatus* var. *superbiens* Berk. from western Australia, with "Gills distant, adnato-decurrent, yellowish at length orange in dry specimens." Dörfelt (1983c) and Pegler and Young (1987) maintained this taxon as a variety of *Xerula radicata* (or *Oudemansiella radicata*), but in light of the studies of *X. megalospora* it is doubtful that var. *superbiens* is a variety of *X. radicata*. *Agaricus radicatus* var. *superbiens* is not identical to *X. megalospora*. It was described with a "... minutely furfuraceous ..." stipe and the spores of the type illustrated by Dörfelt (1983c) and described by Pegler and Young (1987) are ellipsoid not limoniform.

Oudemansiella radicata f. *rubescens* Melik-Hachatrjan (1970) was described from Armenian S.S.R. with a reddish pileus with intensely coloured flecks and yellow lamellae. Dörfelt (1985) obtained an isotype and described the lamellae as the same colour as that described for *A. radicatus* var. *superbiens*. A black and white photograph by Dörfelt shows a fungus very much like dried *X. megalospora*, with a pale pileus and pale, glabrous stipe, and dark (? reddish, ? orangish) lamellae. Dörfelt also mentions the presence of hyphae in the gelatinous pileipellis. The combination of a reddish pileus with yellow lamellae indicates that *O. radicata* f. *rubescens* is not identical to *X. megalospora*. As with *A. radicata* var. *superbiens*, it is doubtful that *O. radicata* f. *rubescens* is a variety or form of *X. radicata*.

Most illustrations of North American material identified as *Collybia* or *Oudemansiella radicata* are referable to *X. furfuracea*, however pl. 54 in Güssow and Odell (1927) appears to be *X. megalospora*. Unfortunately the specimens they photographed are not in DAOM.

Xerula rubrobrunnescens Redhead, Ginns & Shoemaker sp. nov.
Figs. 4-5, 40-51

Pileus 25-82 mm latus, convexus, planescens, umbonatus, ferrugineus vel cinnamomeus, humidus, rugosus, opacus. Caro alba, ferruginescens. Lamellae late adnatae, ventricosae, albae, ferrugineomarginatae. Stipes 80-115 mm X 2-10 mm, albus, striatus, aridus, badiescens vel ferruginascens. Pseudorhizoma usque ad 110 mm longus. Pileus pellicula viscida, hymenimorpha; cellulae clavatae vel pyriformes, leves, fuscae. Lamellae tramis stratosae, gelatinosae. Pleurocystidia 100-115 X 18-25 µm, capitata, levia. Cheilocystidia ventricosa, 65-80 X 17-21 µm. Basidia 58-61 X 10-12.5 µm, tetraspora, clavata. Basidiosporae 13.5-16 X 8-9(-10) µm, limoniformes vel amygdaliformes, hyalinae, inamyloideae, scabridae. Hyphae sarcodimiticae, fibulatae.

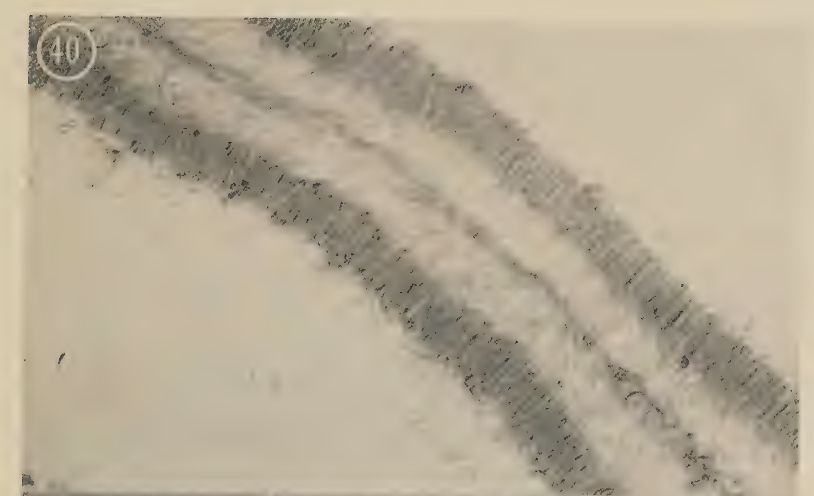
In radicibus.

Pilei 25-82 mm wide, convex, becoming plane with a prominent broad umbo, rust to cinnamon coloured with some hazel to honey coloured areas, smooth on the disc, strongly rugose in the surrounding area, moist, opaque; context fleshy, white, staining rust coloured when cut; neither odor or taste distinctive. Lamellae broadly adnate, broadly ventricose, moderately spaced, with 2 tiers of lamellulae, white, marginate with rusty coloured edges, staining darker upon handling. Epigeous stipes 80-115 mm long, 2-10 mm diam apically, 3-20 mm diam basally, slightly twisted, longitudinally striate-ridged, white, dull, and dry, intensely staining bay to rust coloured upon handling; pseudorhizae up to 110 mm long, white, staining bay to rust coloured upon handling, tapered below to 1-2 mm, attached to dead roots.

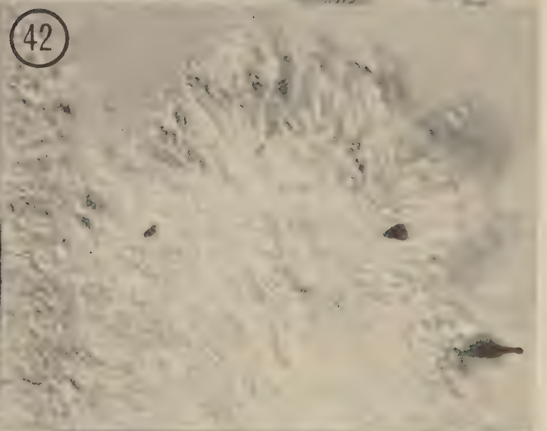
Pileipellis a gelatinized, subhymeniform layer of clavate-pyriform, ± pedicellate cells 45-55 x 20-23 µm, with smooth, thin walls, fuscous contents, and basal clamps, subtended by a subgelatinized intricately interwoven subpellis. Context monomitic, composed of loosely organized elongated cells, 15-20 µm diam, with smooth, thin walls. Lamellar trama bilateral, composed of a nongelatinized, sarcodimitic mediostratum with descending fusoid cells up to 300 x 35 µm bound by finer hyphae mostly 3 µm diam; laterostratum distinctly gelatinized, monomitic, with hyphae 5-9 µm diam, somewhat interwoven. Pleurocystidia abundant, scattered, hyaline or with reddish brown contents, fusoid with a subacute or capitate apex, thin to only slightly thickened walls, smooth, 100-115 x 18-25 µm, neck 4-6 µm diam, capitulum when present 6-7.5 µm diam, a few with contents taking up cotton blue intensely over 24 hrs. Cheilocystidia abundant, forming a sterile edge, mostly ventricose, thin-walled, 65-80 x 17-21 µm, with a few intermingled, pleurocystidia-like individuals taking up cotton blue. Basidia 58-61 x 10-12.5 µm, elongate-clavate, 4-spored, clamped. Basidiospores 13.5-16 x 8-9 (-10) µm, limoniform to amygdaliform, hyaline, with slightly thickened, acyanophilous, nonamyloid, finely roughened (LM) walls, a prominent apiculus, and one

---

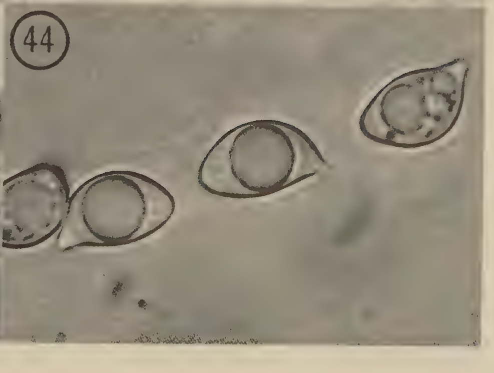
Figs. 40-44. *Xerula rubrobrunnescens*. Fig. 40. Lamellar trama, L. K. Henry 4425 (ex Carnegie Mus 12512, NY), ca. 120 X. Fig. 41. Immature pleurocystidium lacking capitulum, DAOM 196931, ca. 480 X. Fig. 42. Cheilocystidia, Henry 4425 (NY), ca. 190 X. Fig. 43. Pleurocystidium stained with cotton blue after 48 hrs., Henry 4425 (NY), ca. 190 X. Fig. 44. Basidiospores, DAOM 196931, ca. 1200 X.

40


41

42


43

44


or more large guttules. Stipitipellis a loose layer of hyphae 3.5-6 µm bearing abundant, scattered, caulocystidia-like hyphal ends 11-12 µm diam, fusoid, sometimes with constricted apices, smooth walls. Stipe trama sarcodimitic, fusoid cells parallel, 15-20 µm diam, several 100 µm long, bound by hyphae mostly 3-5 µm diam; walls smooth, hyaline, slightly thickened.

Habitat: solitary to gregarious from buried roots in mixed forests.

Range: Canada: Québec. U.S.A.: Pennsylvania, Vermont, Virginia.

Specimens examined: Canada: Québec: Gatineau Co., Cantley, St. Elizabeth Rd., Ginns farm, July 15, 1986, J. Ginns (DAOM 196931); Ile Jesus, Ste. Dorothée near Montréal, Aug. 26, 1941, R.F. Cain (TRTC 50975); Levis Co., St-Nicolas, Sept. 8, 1951, R. Pomerleau (QFB 11584); L'Ilet Co., St-Aubert, Sept. 6, 1948, R. Pomerleau (QFB 10487). U.S.A.: Pennsylvania: Allegheny Co., NE of Sewickly, Sept. 17, 1938, L.K. Henry (NY); Butler Co., Sept. 12-13, 1935, L.K. Henry (NY), NE of Harmony, Sept. 8, 1940, L.K. Henry p.p. (NY); Cambria Co., near Belsano, Sept. 77, 1942, D.R. Sumstine (NY); Elk Co., S of Kane, July 4, 1939, G.H. Sumstine (NY); Indiana Co., N of Creekside, July 15, 1953, L.K. Henry p.p. (NY); Washington Co., near Houston, Sept. 21, 1940, L.K. Henry 4425, ex Carnegie Museum 12515 (NY, HOLOTYPE); Westmoreland Co., Sept. 11, 1940, L.K. Henry p.p. (NY). Vermont: Middlebury, Aug. 14, 1897, E.A. Burt (Dearness herb. at DAOM); Newfane Hill, Aug. 22, 1936, V.K. Charles (BPI). Virginia: Chesterfield Co., near Skinquarter, Sept. 18, 1974, K.H. McKnight 14333 (BPI).

Xerula rubrobrunnescens appears not to have been described formally or informally in the literature. Its relative rarity and its resemblance to *X. furfuracea* in the field are no doubt contributing factors to its obscurity. None of the species or varieties described by Dörfelt (1979-1986) or Pegler and Young (1987) has gelatinized, stratose lamellar tramas (cf. Fig. 40). The capitate pleurocystidia resembling bowling pins (Figs. 43, 45) and staining of the flesh and stipe (Figs. 4-5) are also distinctive.

Xerula rugosoceps (Atkinson) Redhead, Ginns & Shoemaker, comb. nov.
Figs. 52-64, 73.
= *Collybia rugosoceps* Atkinson, Jour. Mycol. 8: 112-113. 1902.

Pilei 30-60 mm wide, convex and umbonate, subviscid, pale brown to pale yellowish brown with a whitish undertone, with a paler margin, with a sordid yellowish brown umbo and small rivulose ridges around the umbo radiating out into coarse rivulose ridges which reach a ridge around the margin, the margin faintly striate; colour of context, odor and taste not recorded. Lamellae sinuate, white, ventricose. Epigeous stipe 30-80 mm long, 3-6 mm diam, twisted, white apically, pale brown and striate over a whitish ground colour, finely floccose when dried and slightly magnified; pseudorhizae up to 50 mm long, tapered below.

Pileipellis a gelatinized, subhymeniform layer, with discrete raised gelatinized ridges (Fig. 54) running out from the umbo, on the umbo composed of a palisade of elongated clavate to mucronate cells 80-170 x 18-30 µm (Fig. 53, 62a) mostly with thin walls and scattered elements with thickened walls mainly towards the bases, hyaline or with

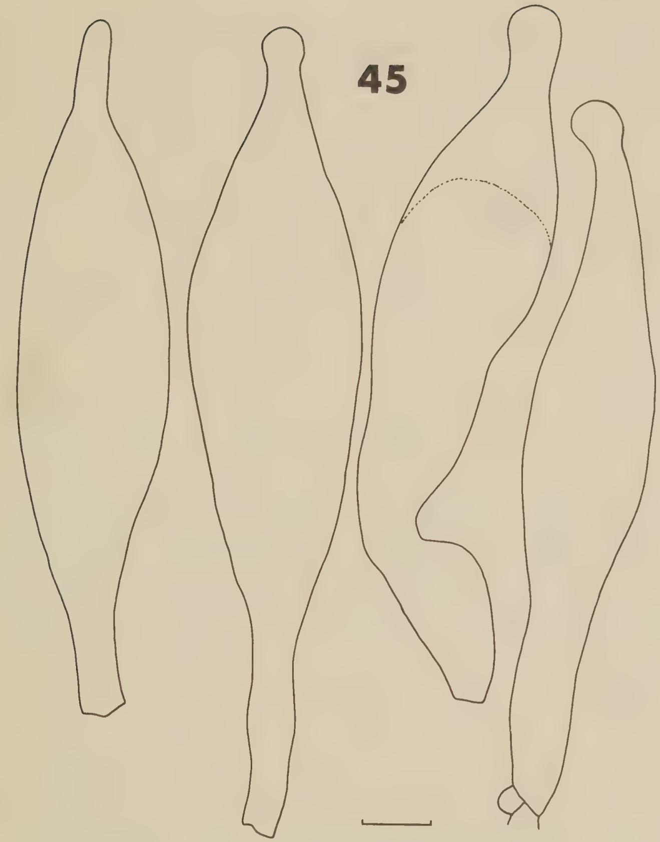
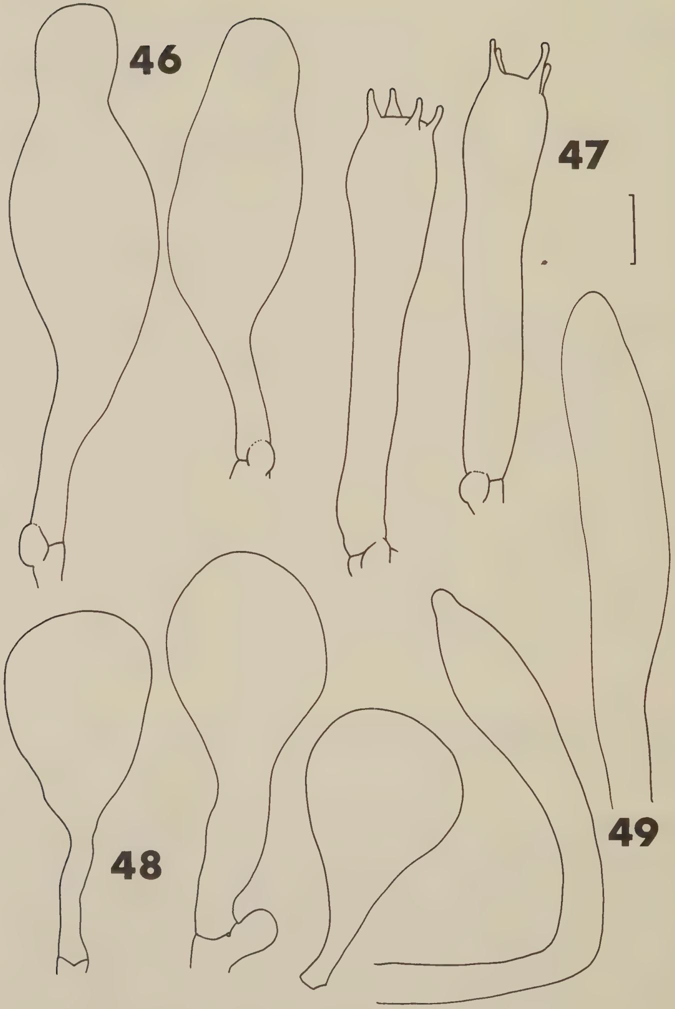


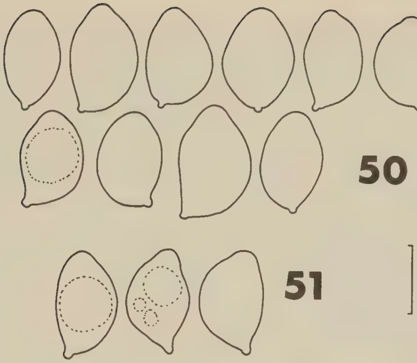
Fig. 45. *Xerula rubrobrunnescens*, Henry 4425 (NY), pleurocystidia. Scale = 10 µm.

---

brownish contents, in surrounding areas composed of shorter, broader, clavate to capitate-pedicellate cells 35-60 x 20-33 µm (Fig. 62b). Context monomitic, composed of loosely organized elongated cells, 12-30 µm diam, with smooth, mostly thin walls. Lamellar trama sarcodimitic, fusoid cells 100-200 µm long, 12-22 µm diam, descending, bound by hyphae mostly 4-5 µm diam, smooth, hyaline, all hyphae with slightly thickened walls (Figs. 52, 55). Pleurocystidia (Figs. 57, 63) abundant, scattered, prominently projecting, 100-120 x 23-36 µm, fusoid to ventricose with a broadly rounded apex, thin-walled, often with oily exudates near the apices. Cheilocystidia (Figs. 56, 64) abundant, forming a sterile margin, seated on a gelatinous matrix, 80-110 x 15-22 µm, narrowly fusoid to clavate, thin-walled, hyaline. Basidia 53-57 x 11-12 µm, clavate, 4-spored, clamped. Basidiospores (Figs. 60-61, 73) 9.5-13.5 x 7-9.5 µm, predominately broadly ellipsoid to subovoid, with



Figs. 46-49. *Xerula rubrobrunnescens*, Henry 4425 (NY). Fig. 46. Cheilocystidia. Fig. 47. Basidia. Fig. 48. Pileipellis elements. Fig. 49. Caulocystidia-like hyphal ends from stipe apex. Scale = 10 µm.



Figs. 50-51. *Xerula rubrobrunnescens* basidiospores. Fig. 50. Henry 4425 (NY). Fig. 51. DAOM 196931. Scale = 10 µm.

---

thin to slightly thickened acyanophilous, nonamyloid walls, a prominent apiculus, usually one large guttule. Stipitipellis a loose layer on hyphae 4-10 µm diam, bearing collapsed, thin-walled cystidia and cystidioid ends. Caulocystidia (Fig. 58) 50-165 x 12-22 µm, inconspicuous, collapsed against the surface, varying from narrowly fusoid to clavate. Stipe trama sarcodimitic, the fusoid cells 18-20 µm diam, several hundred micrometers long, bound by hyphae mostly 4-5.5 µm diam, walls slightly thickened, smooth, hyaline.

Habitat: solitary to gregarious from buried substrates in hardwood forests.

Range: Canada: Québec. U.S.A.: New York, Maryland, Pennsylvania.

Specimens examined: Canada: Québec: Montcalm Co., St-Alexis, July 4, 1948, R. Pomerleau (QFB 19879). U.S.A.: New York: Ithaca, South Hill woods, July 27, 1902, C.O. Smith (HOLOTYPE of *Collybia rugosoceps*, CUP-A 13062). Maryland: Prince Georges Co., Beltsville, May 22, 1973, M.L. Farr 4284 (BPI). Pennsylvania: Center Co., near Shingletown Gap, Aug. 1, 1930, C.S. Parker 1794 (BPI).

This rare species is distinguished by the relatively small spores compared to others in section *Radicatae*, the prominent ridges on the pileipellis, and by the elongated pileipellis elements on the umbo. It is most similar to *X. radicata* var. *radicata* which also forms ventricose pleurocystidia, but the latter has more regularly ellipsoid, larger basidiospores, and does not have discrete ridges formed by folds in the pileipellis. Additional data on this species in the fresh condition may reveal other distinguishing features.

The type of *Xerula rugosoceps* has slightly smaller basidiospores than the three other collections cited, i.e. 9.5-12.2 x 7-8.5 µm (Fig. 73) versus 11-13.5 x 8-9.5 µm (Figs. 60-61). In other respects the specimens are similar and all are treated as conspecific until additional data can be obtained. The spores are possibly immature.

EXTRALIMITAL OR EXCLUDED TAXA EXAMINED

Agaricus (Collybia) texensis Berkeley and Curtis

Specimen examined: U.S.A.: Texas: C. Wright, 3162 (LECTOTYPE, FH), C. Wright s.n. (BPI).

The type of this name was reported to be an *Oudemansiella* by Halling (1983). Re-examination of the type showed it to have among other features, a gelatinized ixocutis with large, erect, tapered, brownish pileocystidia, and subcylindrical basidiospores 7.2-8.5 x 3.5-4.5 µm. We considered it to be synonymous with *Flammulina velutipes* (Curt.) Singer.

Oudemansiella canarii (Jungh.) Höhnel

Specimen examined: Peru: Tingo Maria, Oct. 31, 1948, J.B. Carpenter 113 (BPI, det. R. Singer).

This species has been reported from Florida on a variety of hosts (Singer 1945).

Oudemansiella mucida (Schrad.: Fr.) Höhnel

Specimen examined: Czechoslovakia: northern Moravia, Silberovice, Aug. 11, 1975, V.B. McKnight 15557 (BPI).

Oudemansiella mucida has been reported on a beech tree from Vancouver, B.C. (Cheesman 1910). Beech is not native to British Columbia, thus the report may be legitimate and based upon an introduction with the tree. Kauffman (1922) was skeptical about early reports of *O. mucida* (as *Armillaria mucida*) from North America. To our knowledge there are no reports documented by specimens.

Xerula americana Dörfelt

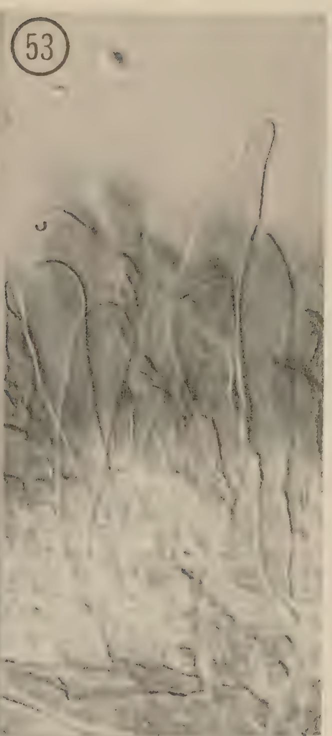
Specimen examined: U.S.A.: Pennsylvania: Allegheny Co., Pughtown, Frick Park, Aug. 4, 1939, M.B. Knauz (NY).

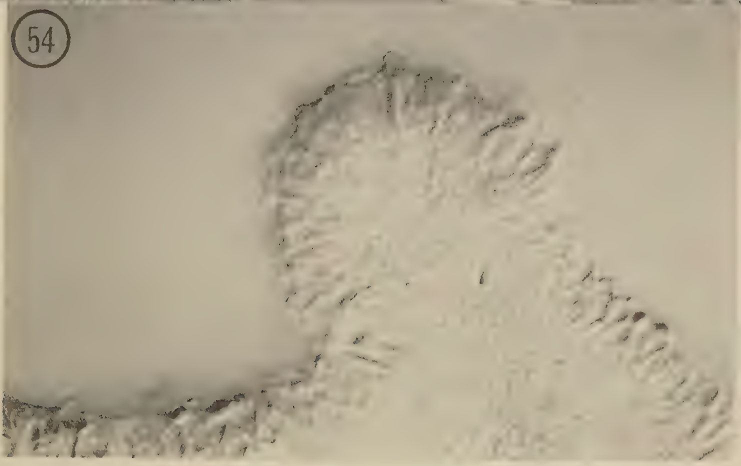
Bisby et al. (1929 p. 32) reported that *Collybia radicata* was absent in Manitoba, however on page 100 they reported an unusual form of the species with spores 9-12 x 6-7 µm. In the later compilation (Bisby et al. 1938), *Collybia radicata* was deleted from the list and *C. longipes* was added. Mitchel and Smith (1978) described North American collections formerly considered to be *C. longipes*, as a new variety, *Oudemansiella longipes* var. *americana*. Their name was invalidly published because the combination *Oudemansiella longipes* was not valid. Dörfelt (1981a) validated Mitchel and Smith's name at the species level. The species was known only from western, montane areas (Colorado, Idaho, New Mexico, and Wyoming). Unknown to us, Dörfelt (1986) studied a culture labelled *Oudemansiella radicata* var. *americana* from Manitoba (DAOM 180395) which was originally obtained

---

Figs. 52-54. *Xerula rugosoceps*, QFB 19879. Fig. 52. Lamellar trama, ca. X 190. Fig. 53. Pileipellis elements from disc area, ca. X 480. Fig. 54. Pileipellis fold in section, ca. X 190.

(52)


(53)


(54)

from the Canadian Collection of Fungus Cultures in Ottawa. He drew attention to differences between basidiomes obtained in culture from those of *X. americana*. The culture was isolated from a single basidiome collected by S.A.R. and tentatively identified as Mitchel and Smith's variety. Reexamination of the specimen shows it to be a species of *Flammulina* allied to or conspecific with *F. fennae* Bas (1983). *Flammulina* in Canada will be discussed in a separate paper. Materials of neither *Collybia radicata* nor *C. longipes* reported from Manitoba by Bisby et al. (1929, 1938) are available at present.

Xerula radicata (Rehl.) Dörfelt var. *radicata* Figs. 65-67.

Specimens examined: Austria: lower Austria, Gelber Berg near Purkersdorf, F. Höhnel (Kryptogamae exsiccatae 2111 *Collybia radicata*, BPI); Vienna, Aug. 18, 1975, K.H. McKnight 15759A (BPI). China: Chekiang, Hangchow, June 23, 1932, S.C. Teng 1131 (BPI); Kiangsu, Nanking, May 15, 1931, K.L. Teng 463 (BPI), Pao-hua-shan, June 10, 1932, T.C. Teng 994 (BPI). Czechoslovakia: Northern Moravia, Silberovice, July 11, 1975, K.H. McKnight 15578 (BPI); Southern Moravia, near Stary Poddvorov, June 28, 1975, L.B. McKnight 15458 (BPI). England: Surrey, Kew Gardens, no date, no collector, ex herb. G. Massee (NY). Germany: Berlin, Aug. 1890, P. Hennings (NY). Italy: S. Antonio, Aug. 31, 1900, G. Bresadola (BPI). Sweden: Småland, Femsjö Parish, Sept. 1943, S. Lundell (Fungi Exs. Suecici 1718, *Collybia radicata*, DAOM). U.S.A.: Alabama: Auburn, July 1896, L.M. Underwood & F.S. Earle (NY). Pennsylvania: Allegeheny Co., near Montour Run, July 3, 1940, L.K. Henry (NY), Fern Hollow, July 23, 1906, D.R. Sumstine (NY), North Park, Sept. 6, 1936, L.K. Henry (NY); Beaver Co., Potato Garden Run, Sept. 19, 1956, L.K. Henry (NY); Butler Co., near Monroe Station, Sept. 9, 1937, L.K. Henry (NY); Fayette Co., New Geneva, Aug. 29, 1950, L.K. Henry (NY), Ohiopyle, July 1905, D. R. Sumstine (NY), Sept. 10, 1905, O.E. Jennings & G.E. Kinzer (NY); Westmoreland Co., along Loyalhanna Creek, June 12, 1940, L.K. Henry (NY). Virginia: Blacksburg, July 27-Aug. 3, 1904, W.A. Murrill (NY).. U.S.S.R.: Caucases, "Fauces Petzvir", June 4, 1912, G. Woronow 211 (BPI).

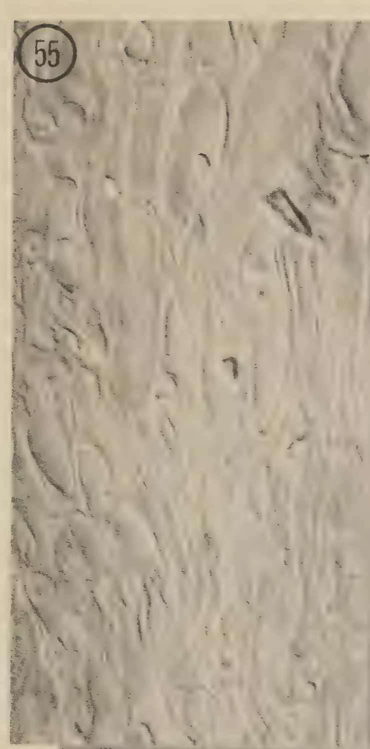
Although often reported in the literature from eastern North America, very few verifiable collections of *X. radicata* var. *radicata* have been seen. All Canadian collections have been redisposed as *X. furfuracea*, *X. megalospora*, *X. rugosoceps* or *X. rubrobrunnescens*. McKnight collection 15578 has marginate lamellae and could be called forma *marginata* Konrad & Maublanc. However at present this variation is not considered to be taxonomically important.

Xerula radicata var. ? *africana* Dörfelt Figs. 68-69.

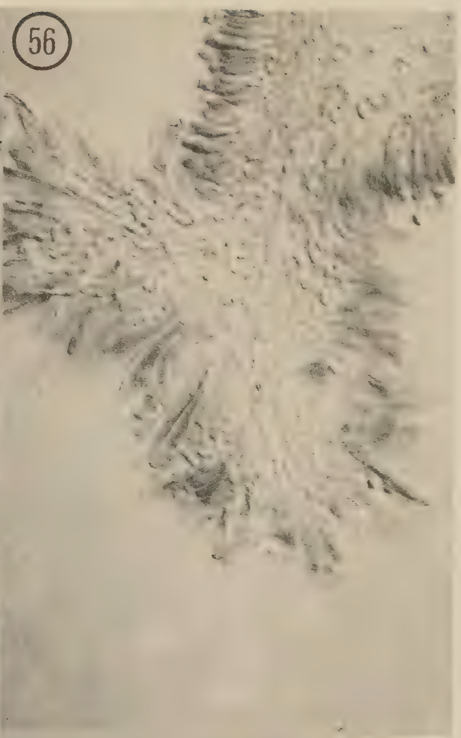
Specimens examined: U.S.A.: Connecticut: Redding, July 22, 1902, F.S. Earle 565 (NY). Maryland: Congressional Club, July 6, 1933, V.K. Charles (BPI). Pennsylvania: Allegheny Co., Pittsburgh, R. Pflaum, Sept. 21, 1904 (NY). Virginia: Massanutten Mt., June 15, 1938, V.K. Charles (BPI).

Figs. 55-57. *Xerula rugosoceps*, QFB 19879. Fig. 55. Lamellar trama, ca. X 480. Fig. 56. Cheilocystidia on gelatinized lamellar edge, ca. X 190. Fig. 57. Pleurocystidium, ca. X 480.

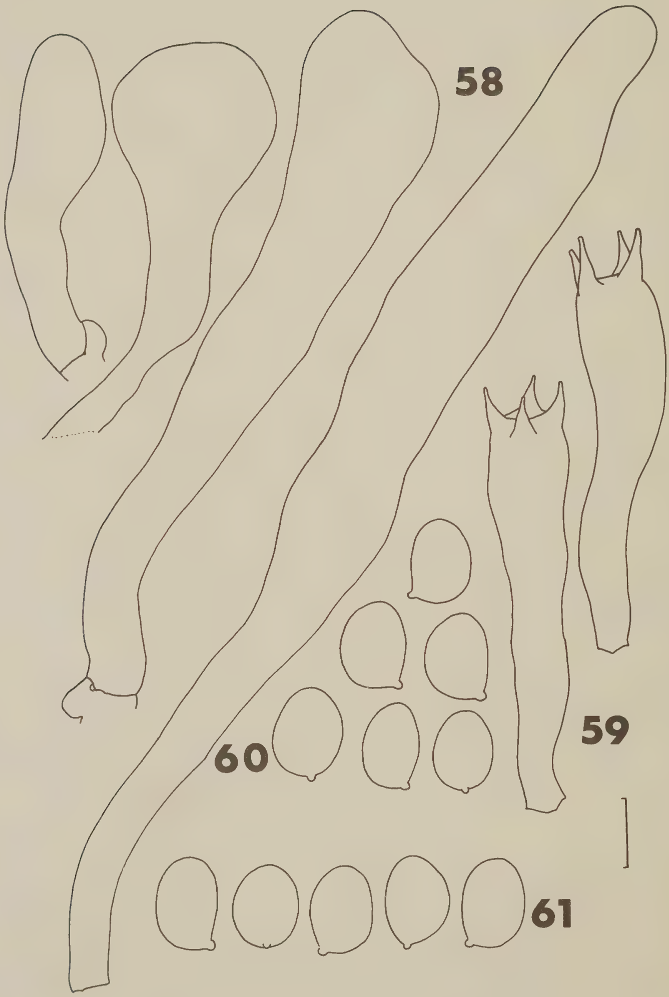
(55)



(56)



(57)



Figs. 58-61. *Xerula rugosoceps*. Fig. 58. Caulocystidia, M.L.F. 4284 (BPI). Fig. 59. Basidia, QFB 19879. Fig. 60. Basidiospores, QFB 19879. Fig. 61. Basidiospores, M.L.F. 4284 (BPI). Scale = 10 µm.

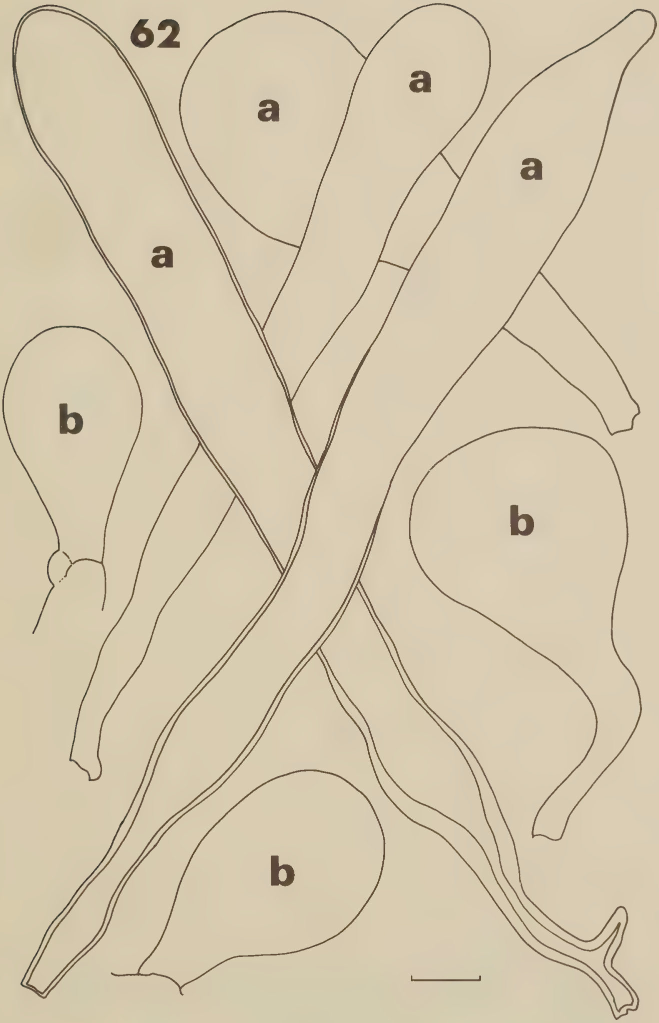


Fig. 62. *Xerula rugosoceps*, QFB 19879, pileipellis elements from disc (a) and peripheral regions (b). Scale = 10 µm.

63

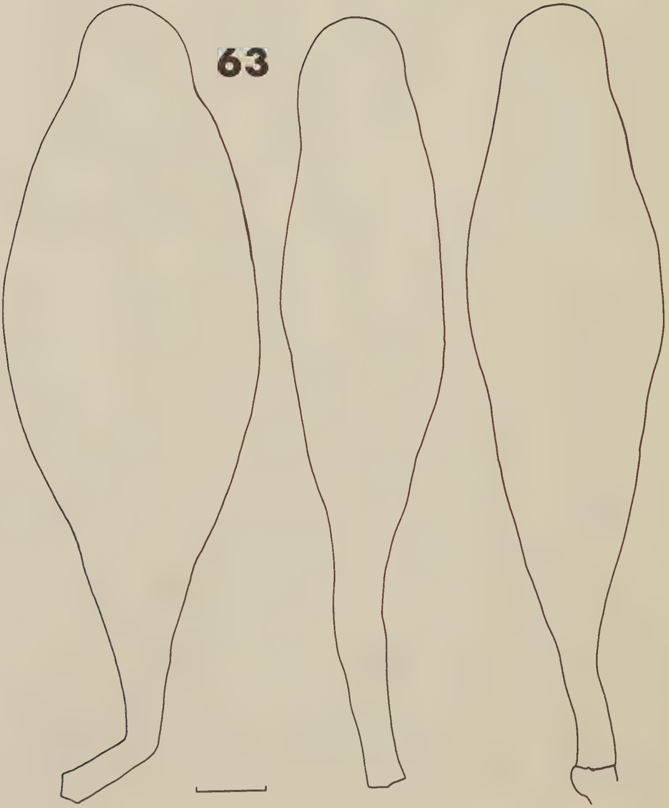


Fig. 63. *Xerula rugosoceps*, QFB 19879, pleurocystidia. Scale = 10 µm.

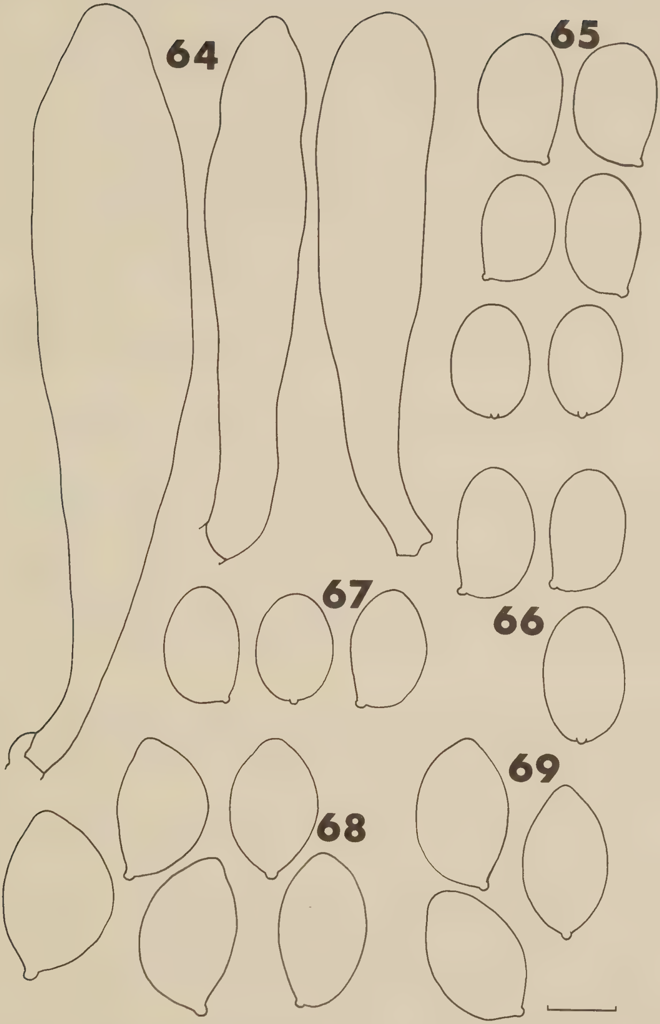


Fig. 64. *Xerula rugosoceps*, QFB 19879, cheilocystidia. Figs. 65-67. *Xerula radicata* var. *radicata* basidiospores. Fig. 65. Fungi Ex. Suecici 1718 (DAOM). Fig. 66. L.K. Henry, July 3, 1940, Allegeheny Co., Pa. (NY). Fig. 67. L.K.Henry, Sept. 19, 1956, Beaver Co., Pa. (NY). Figs. 68-69. *Xerula radicata* var. *?africana*. Fig. 68. V.K. Charles, Maryland (BPI). Fig. 69. V.K. Charles, Virginia (BPI). Scale = 10 µm.

These collections are in relatively poor condition and the shape of the pleurocystidia could not be accurately determined. They appear to be ventricose as in both *X. radicata* var. *radicata* and *X. rugosoceps*. The basidia are 4-spored, clamp connections are present, and the cheilocystidia are fusoid to ventricose and embedded in a gelatinous matrix much like *X. furfuracea*, *X. rugosoceps*, and both *X. radicata* var. *bispora* and var. *radicata*. Pileocystidia are lacking as are distinct caulocystidia. The stipes are glabrous. The distinctive feature of this taxon is the large spore size, 20-25 x 12.5-14.5 µm, comparable to that of *X. megalospora* and *X. radicata* var. *bispora*, but much larger than those of *X. radicata* var. *radicata* and *X. furfuracea*. Additional collections and study will likely lead to the recognition of this fungus at the species level.

Xerula radicata var. *africana* was originally described from Tanzania (Dörfelt 1984).

Xerula radicata var. *bispora* Redhead, Ginns & Shoemaker, var. nov.
Figs. 14, 20

A X. radicata var. radicata basidiis bisporis, basidiosporis grandioribus, 21-23 x 14-16 µm, fibulis destitutis differt.

Specimens examined: England: Surrey, Aug. 20, 1962, D.A. Reid (DAOM 96902). Hungary: near Budapest, Aug. 11, 1975, Babos & McKnight 15715 (BPI). Italy: Mendola near Trento, Aug. 1900, G. Bresadola (NY). Sweden: Uppland, Upsala, Sept. 11 & 16, 1946, Sept. 22, 1950, A. Melderis (DAOM 65342, 65343, 65341), Sept. 16, 1971, N. Lundqvist 7353 (HOLOTYPE: DAOM 171289; ISOTYPE: BPI). U.S.A.: Connecticut: East Hartford, Sept. 13, 1903, C.C. Hanmer 1573 (BPI). District of Columbia: Washington, monument grounds, Aug. 19, 1923, H.M. Daly (BPI). Iowa: Iowa City, Sept. 27, 1936, A.J. Stanley (NY).

Apparently this bisporous taxon has not been recognized previously. It is unreported in European treatments (Dörfelt 1979, 1983a; Moser 1983; Kühner and Romagnesi 1953; Pegler and Young 1987; Pilát 1951) where spore size is considered an important feature. In North America this fungus is rare.

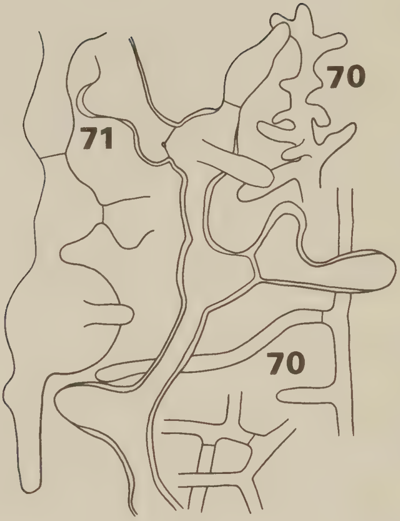
CULTURAL CHARACTERS OF *XERULA FURFURACEA* AND *X. MEGALOSPORA*

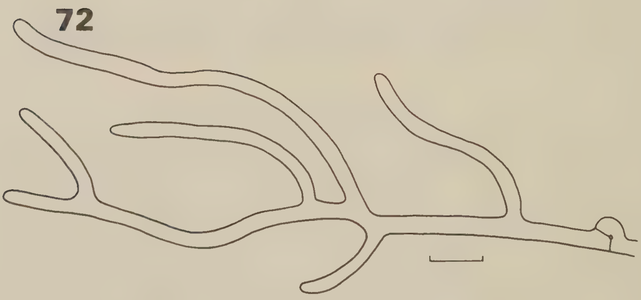
X. furfuracea: Growth at 25° C at an intermediate rate, the mats covering the 85 mm plates in 4 to 5 weeks. Mats at 2 weeks 45-50 mm in radius, white, typically with a few tan to brown (near 7.5YR5/6) patches, typically densely woolly, raised to 1 mm thick with a broad (15 mm wide), sparsely woolly or downy marginal zone, some isolates weakly zonate due to alternating bands of dense and relatively sparse mycelium, the outer edge of the mat essentially even, sparse, finely fimbriate, partially submerged. At 6 weeks, mats basically white, weakly concentrically zonate, typically with one or a few, small (to 10 mm diam) to large, brown to yellow brown (near 7.5YR7/6), crustose patches or zones which cover a surface layer of white or cream color (paler than 10YR8/6) mycelium, some isolates with the texture variable from downy to woolly. Odor at 2 weeks lacking, at 6 weeks lacking or typically musty or weakly spicy. Petri plates on the reverse side lacking any bleaching or staining of the agar. Tests for tyrosinase (Käärik 1965) with p-cresol and tyrosine were negative. Tests for laccase with syringaldazine (Harkin et al. 1974) and guaiacol (Käärik 1965) were positive but the reactions were weak, i.e., rose and pale orange, respectively, after 3 to 5 minutes. Laccase tests with gallic acid agar, tannic acid agar, and gum guaiacum (Nobles 1965) were negative, except on gallic and tannic acid agars isolate 196105 gave a weak reaction, isolate 196108 gave a negative to weakly positive reaction and 196110 gave a negative to weakly positive reaction on tannic acid. None of the isolates grew on tannic or gallic acid agars.

At 2 weeks the advancing edge with adnate and submerged hyphae radiating, sparse, infrequently branched, 3-4 (-6) µm diam, with single clamp connections, the walls hyaline and thin. About 100 µm behind the margin some terminal cells 2 um diam were aseptate, dichotomously branched and resembled staghorns (cf. Fig. 72). Hyphae on the surface of the agar distinct, loosely woven, 2-4 (-7) µm diam, with single clamp connections and scattered simple septa and a few retraction septa, clamp connections common, rather prominent, often slightly inflated to a cushion-shape, branches infrequent, walls hyaline, rarely pale yellow, nonamyloid, smooth, typically thickened to 0.5 µm, contents typically homogeneous but some hyphae with numerous, globose, pale yellow droplets 0.5-1 µm diam. The tan or brown patches were composed of cuticular cells (globose cells up to 15 µm diam, fig. 71) and interlocking hyphae (irregularly shaped to lobed cells, fig. 71), some cells of both types had numerous short, straight branches. The cuticular and interlocking cells were covered by a densely woven network of much branched, narrow (1.5-2.5 µm diam) hyphae which had short (10-20 µm long) branches diverging at right angles (Fig. 70). Some to many of the cuticular cells, interlocking cells and the narrow hyphae had walls thickened and yellow brown. At 6 weeks the surface hyphae as at 2 weeks, except some hyphal segments had small (-4 µm diam), subhyaline to pale yellow, resinous droplets scattered over the surface, the cuticular and interlocking cells with walls often thickened to 1 µm, and the narrow, much branched hyphae had thickened, pigmented walls.

X. megalospora: Growth at 25 C at an intermediate rate, the mats covering the 85 mm plates in 3 to 6 weeks. Mats at 2 weeks, 35-60 mm in radius, white or typically white with tan to brown patches, texture varying between cultures and between replicate plates of one individual, typically sparse woolly, woolly or woolly floccose, weakly concentrically zonate with alternate bands of dense and relatively sparse mycelium, scattered membranous or crustose patches which were brown or infrequently white, in some cultures the texture around the inoculum (-10 mm radius) was pruinose or sparse downy; margin even, sparse, the extreme 1-2 mm submerged or raised to the limit of growth, finely fimbriate. At 6 weeks mats typically white with prominent crustose, brown patches or paper-thin lines in the agar, some replicates with little or not any brown color, appressed, sparsely downy, sparsely woolly, woolly or woolly floccose.

Reverse unchanged at 2 and 6 weeks. Odor lacking at 2 weeks, at 6 weeks lacking or weakly spicy on two individuals and weakly moldy on one. Tests for tyrosinase with p-cresol and tyrosine were negative. Tests for laccase with syringaldazine (rose color at 3 minutes), guaiacol (pale orange at 5 minutes), gallic acid agar and tannic acid agar were positive, except 196116 was negative on both gallic- and tannic acid agars. With gum guaiacum the reactions of the four cultures were negative.





Figs. 70-71. *Xerula furfuracea*, DAOM 196108, 6 week old culture. Fig. 70. Narrow, much branched hyphae. Fig. 71. Developing cuticular and interlocking cells. Fig. 72. *Xerula megalospora*, DAOM 196115, 2 week old culture. Terminal staghorn-like cell from the margin of the mycelial mat. Scale = 5 µm.

At 2 weeks the advancing edge with hyphae having a single clamp connection at each septum, thin-walled, hyaline, (1-) 4-6 µm diam, infrequently branched with some unusual, scattered, staghorn-like, aseptate, branches, 1.5 µm diam, diverging perpendicular and branching dichotomously (Fig. 72), and aerial hyphae 2-3 µm frequently branched, short-celled, with clamp connections. Aerial hyphae of the older portions of the mats 1.5-2.5 (-5) µm, with single clamp connections. Surface hyphae loosely woven, 1.5-3 µm diam, frequently branched, with clamp connections, the walls moderately thick, hyaline. White or brown membranous patches composed of tightly woven cuticular cells (some globose, up to 20 µm diam) and interlocking hyphae (irregularly shaped, 2-4 µm diam, much branched), thin- to slightly thick-walled. Dense white lines composed of densely woven, much branched hyphae, 1-3 µm diam, some terminal swellings to 5 µm which have numerous short branches up to 10 µm long. At 6 weeks the mats more or less stratose with a layer of surface hyphae overlain with a layer of cuticular and interlocking cells and in some areas the cuticular and interlocking cells were under an indistinct layer of densely woven, narrow, much branched hyphae. Cuticular cells mostly globose, 10-30 µm diam, and interlocking hyphae lobed or gnarled, both with clamp connections and some simple septa, the walls hyaline or pigmented, thin or up to 2 µm thick. Surface hyphae as at 2 weeks but some with external droplets which stain pink in phloxine. The narrow hyphae were 1.5-3 µm diam, frequently branched, with the branches short and essentially perpendicular, septa few and simple.

Species codes (Nobles 1965):
X. furfuracea:
(1).(2).3.10.11.(21).24.32. 36-37 .38.44-45.(53).56.59.
X. megalospora:
(1). 2. 3.10.11.(21).24.32.(36).37.38.43-46.(53).56.59.

Mating systems: Both *X. furfuracea* and *X. megalospora* have a unifactorial (i.e. bipolar) mating system. In 196105, a collection of *X. furfuracea*, ten monospore cultures were determined, by matings to be A_1 : 1, 3, 6, 7, 9; A_2 : 2, 4, 5, 8, 10. Three matings which did not produce clamp connections but should have were 1x4, 1x8 and 2x9. In 196107, a second collection of *X. furfuracea*, ten monospore cultures were determined to be A_3 : 1, 4, 5; A_4 : 2, 3, 6, 7, 8, 9, 10. Five matings which should have produced clamp connections did not. They were 1x3, 1x6, 1x10, 4x6, 4x10. Although some matings had produced clamp connections by 3 weeks it was necessary to reexamine the matings after 7 and 14 weeks before the mating type of all the monospore cultures could be determined. In *X. megalospora*, ten monospore cultures from 196130 were determined by matings to be A_1 : 1, 2, 4, 6, 8, 9, 12 and A_2 : 3, 10, 11. Monospores numbered 10 and 12, each produced clamp connections in only one mating, 8x10 and 3x12. The production of clamp connections was very slow and some compatible matings did not form clamp connections until 11 weeks after mating.

No clamp connections were found in the 32 matings of single spore cultures of *X. furfuracea* (196105, 196107) and *X. megalospora* (196130). These matings included two isolates of each mating type from each specimen.

Cultures studied: *X. furfuracea*: DAOM 196105, 196106, 196107, 196108, 196109, 196110. *X. megalospora*: DAOM 196115, 196116, 196130, 196316, 196317.

Discussion of cultural features: Cultures of *X. furfuracea* and *X. megalospora* were very similar and the variation within and between isolates made it difficult to separate them. The cuticular cells and

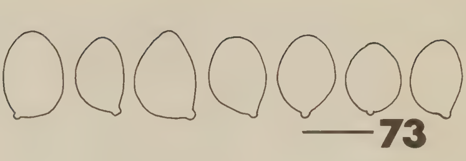


Fig. 73. Basidiospores of type of *Collybia rugosoceps*. Scale = 10 µm.

interlocking hyphae (Fig. 71) arose as swellings and branches from normal, cylindrical hyphae. The cuticular cells were globose and scattered, whereas the interlocking hyphae were predominant, irregularly swollen, branched and lobed. The narrow, much·branched hyphae (Fig. 70) were assigned the code 24 because it was the code in Nobles' (1965) system that most closely fit these hyphae. The staghorn-like branches (Fig. 72) were relatively easy to find at 2 weeks, but could not be found at 6 weeks.

Nobles (as *Collybia radicata*, 1948, 1965) recorded the culture characters of *X. radicata* from North America, which we suspect may have been a mixture of *X. furfuracea* and *X. megalospora*. Nobles' (1948) description differs from ours in some features. She recorded mats of a looser texture, i.e., more downy to cottony than woolly, a strong, penetrating odor, strong diffusion zones on gallic and tannic acid agars, and consistently positive tests for extracellular oxidase.

Campbell's (1938) description of the European "*Collybia radicata*" in pure culture is, despite different growth conditions, similar to our observations of *X. furfuracea* and *X. megalospora*. Campbell's fungus had basidiospores "ellipsoid, averaging 12-16 x 10-11.5 µ" and produced clamp connections in culture, and, therefore, was probably *X. radicata* var. *radicata*. The brown crustose patches produced in most of our cultures are morphologically similar to the fungus tissue that Campbell (1938, p. 151 & 153) saw in the cambial area and wood of naturally infected roots.

GENERAL DISCUSSION

Both *Oudemansiella* and *Xerula* have been remodelled in a series of recent papers (Boekhout and Bas 1986; Clémençon 1979; Dörfelt 1979-1986; Moser 1955, 1983; Pegler and Young 1987). The consensus is that *Xerula* sect. *Radicatae* is closely allied to section *Xerula* and that they are congeneric. Opinions differ about the delimitation of *Oudemansiella*. *Xerula* is placed in synonymy in some schemes. With the exception of the report by Boekhout and Bas (1986) and earlier by Knecht (1967), the anatomy of the species in these taxa has been largely overlooked when the generic concepts were modified. Based upon a study by Scholtes, Boekhout and Bas noted that *O. mucida* had a monomitic stipititrama while *Xerula radicata*, *X. caussei* Maire and *X. longipes* (Bull.) Maire all had sarcodimitic stipititramas. Both *Oudemansiella mucida* and *O. canarii* form a tissue somewhat intermediate between monomitic and sarcodimitic in their stipes (specimens examined). All seven North American species of *Xerula* have sarcodimitic stipititramas. The sarcodimitic structure of the stipititrama of *X. furfuracea* is illustrated by Redhead (1987). Knecht (1967) illustrated the sarcodimitic stipititrama of *X. radicata*. These combined data support the separation of *Oudemansiella* from *Xerula* because they correlate with previously cited differences, i.e. formation of pseudorhizae in *Xerula*, its absence in *Oudemansiella*, and the presence of a veil in *Oudemansiella* and its absence in *Xerula*. The correlated presence of a monomitic stipititrama and nodose, cyanophilous basidiospores in *X. kuehneri* (Romagn.) Bas and Boekhout (1986) suggests generic distinction. *Dactylosporina* (Clémençon) Dörfelt, a genus based on a species with nodose basidiospores, is available if found to consistently have a monomitic stipititrama. *Xerula* and the two closely allied genera *Dactylosporina* and *Oudemansiella* are considered to be members of the Xerulaceae Julich, which is largely distinguished by the presence of sarcodimitic tissues in the basidiomes, usually best developed in the stipititramas (Redhead 1987).

Seven distinct, highly differentiated species of *Xerula* occur in the eastern deciduous and mixed forests of the United States and Canada. Most may be distinguished from each other by macroscopic field characters (furfuraceous stipe and nondistinctive odor of *X. furfuracea*: glabrous, subpolished stipe and odor of geraniums or carrots for *X. megalospora*: dull white stipes with prominent reddish brown bruises and nondistinctive odor of *X. rubrobrunnescens*), or microscopic features. In addition, one develops an orange necropigment in herbaria with napthalene. The number of morphologically and anatomically different features is so great that there is no reason to consider these species as varieties, subspecies, or even as microspecies of each other (cf. Singer 1986, p. 355). Even after these species are distinguished *Xerula radicata* still consists of a number of varieties which will probably prove to be independent species.

ACKNOWLEDGEMENTS

We thank both Dr. J. Bissett and Dr. D. Malloch for reviewing the manuscript and making helpful suggestions. Drs. M. Bolick (NEB), R. Cauchon (QFB), S. Gruff (CUP), J. Krug (TRTC), J. Haines (NYS), R. Halling (NY), D. Pfister (FH), and A. Rossman (BPI) all kindly assisted us by arranging for the loan of materials. Mrs. L. Lefebvre prepared most of the cultures and isolated and crossed the monospore isolates.

REFERENCES

Anke, T. 1985. Cytotoxic metabolites from Basidiomycetes. In Cellular regulation and malignant growth (ed. S. Ebashi) pp. 169-176. Japan Sci. Soc. Press, Tokyo.

Atkinson, G.F. 1902. Preliminary notes on some new species of fungi. J. Mycol. 8: 110-119.

Bas, C. 1983. *Flammulina* in western Europe. Persoonia 12: 51-66.

Berkeley, M.J. 1845. Decades of Fungi III-VII. Australian Fungi. London J. Bot. 4: 42-73.

Berkeley, M.J. and M.A. Curtis. 1853. XLI - Centuries of North American fungi. Ann. Mag. Nat. Hist. (Ser. 2) 12: 417-435.

Bigelow, H.E. 1985. North American species of *Clitocybe*. Part II. Beih. Nova Hedw. 81. J. Cramer, Berlin.

Bisby, G.R., A.H.R. Buller and J. Dearness. 1929. The fungi of Manitoba. Longmans, Green and Co., London.

Bisby, G.R., A.H.R. Buller, J. Dearness, W.P. Fraser and R.C. Russell. 1938. The fungi of Manitoba and Saskatchewan. Natl. Res. Council Can., Ottawa.

Boekhout, T. and C. Bas. 1986. Notulae ad Floram Agaricinam Neerlandicam-XII. Some notes on the genera *Oudemansiella* and *Xerula*. Persoonia 13: 45-56.

Campbell, A.H. 1938. Contribution to the biology of *Collybia radicata* (Relh.) Berk. Trans. Brit. Mycol. Soc. 22: 151-159.

Cheesman, W.N. 1910. A contribution to the mycologic flora and the mycetozoa of the Rocky Mountains. Trans. Brit. Mycol. Soc. 3: 267-276.

Clémençon, H. 1979. Taxonomic structure of the genus *Oudemansiella* (Agaricales). Sydowia 32: 74-80.

Clements, F. E. and R. Pound. 1896. Reports in collections made in 1894-1895. Bot. Surv. Nebraska 4: 1-48. 4: 111-126.

Dörfelt, H. 1973. *Oudemansiella nigra* spec. nov. und ihre phytoconologischen Beziehungen. Ceska Mykol. 27: 27-32.

Dörfelt, H. 1979. Taxonomische Studien in der Gattung *Xerula* R. Mre. Feddes Repertorium 90: 363-388.

Dörfelt, H. 1980a. Taxonomische Studien in der Gattung *Xerula* R. Mre. (II) Feddes Repertorium 91: 209-223.

Dörfelt, H. 1980b. Taxonomische Studien in der Gattung *Xerula* R. Mre. (III) Feddes Repertorium 91: 415-438.

Dörfelt, H. 1981a. Taxonomische Studien in der Gattung *Xerula* R. Mre. (IV) Feddes Repertorium 92: 255-291.

Dörfelt, H. 1981b. Taxonomische Studien in der Gattung *Xerula* R. Mre. (V) Feddes Repertorium 92: 631-674.

Dörfelt, H. 1982. Nomenclatural notes on *Xerula*. Mycotaxon 15: 62-66.

Dörfelt, H. 1983a. Taxonomische Studien in der Gattung *Xerula* R. Mre. (VI) Feddes Repertorium 93: 43-85.

Dörfelt, H. 1983b. Taxonomische Studien in der Gattung *Xerula* R. Mre. (VII) Feddes Repertorium 94: 251-262.

Dörfelt, H. 1983c. Taxonomische Studien in der Gattung *Xerula* R. Mre. (VIII) Feddes Repertorium 94: 549-561.

Dörfelt, H. 1984. Taxonomische Studien in der Gattung *Xerula* R. Mre. (IX) Feddes Repertorium 95: 189-200.

Dörfelt, H. 1985. Taxonomische Studien in der Gattung *Xerula* R. Mre. (X) Feddes Repertorium 96: 235-240.

Dörfelt, H. 1986. Taxonomische Studien in der Gattung *Xerula* R. Mre. (XI) . Feddes Repertorium 97: 397-404.

Güssow, H.T. and W.S. Odell. 1927. Mushrooms and toadstools. An account of the more common edible and poisonous fungi of Canada. Division of Botany, Ottawa.

Halling, R.E. 1983. The genus *Collybia* (Agaricales) in the northeastern United States and adjacent Canada. Mycologia Memoir No. 8. J. Cramer, Braunschweig.

Harkin, J.M., M.J. Larsen, and J.R. Obst. 1974. Use of syringaldazine for detection of laccase in sporophores of wood rotting fungi. Mycologia 66: 469-476.

Hesler, L.R. 1951. Notes on southern Appalachian fungi, IX. J. Tenn. Acad. Sci. 26: 4-14.

Käärik, A. 1965. The identification of the mycelia of wood-decaying fungi by their oxidation reactions with phenolic compounds. Stud. For. Suec. 31: 1-80.

Kauffman, C.H. 1922. The genus *Armillaria* in the United States and its relationships. Pap. Mich. Acad. Sci. 2: 53-67.

Knecht, J. 1967. Zur Stellung von *Oudemansiella platyphylla* (Pers. ex Fr.) Mos. und Vergleich mit *Oudemansiella radicata* (Rehl. ex Fr.) Bours. und *Tricholomopsis rutilans* (Schff. ex Fr.) Sing. Schweiz. Z. Pilzk. 45: 177-187.

Kühner, R. and H. Romagnesi. 1953. Flore analytique des Champignons Supérieurs. Masson et Cie, Paris.

Melik-Hachatrjan, D.G. 1970. Novye formy *Oudemansiella radicata* (Fr.) Sing. iz Armenjanskoj SSR. Mikol. i Fitopatol. 5: 474-475.

Mitchel, D.H. and A.H. Smith. 1978. Notes on Colorado fungi III: new and interesting mushrooms from the aspen zone. Mycologia 70: 1040-1063.

Moser, M. 1955. Studien zur Gattung *Oudemansiella* Speg., Schleim- und Sammetrublinge. Z. Pilzk. 19: 4-11.

Moser, M. 1983. Die Rohrlinge und Blätterpilze. Kleine Kryptogamenflora Bd IIb/2. Gustav Fischer Verlag, Stuttgart.

Munsell Book of Color. 1929-1942. Munsell Color Co., Baltimore.

Murrill, W. A. 1915. The validity of *Clitocybe megalospora*. Mycologia 7: 157-158.

Murrill, W. A. 1916. *Gymnopus*. North Amer. Flora 9(5): 352-376.

Nobles, M.K. 1948. Studies in forest pathology VI. Identification of cultures of wood-rotting fungi. Can. J. Res., C, 26: 281-431.

Nobles, M.K. 1965. Identification of cultures of wood-inhabiting Hymenomycetes. Can. J. Bot. 43: 1097-1139.

Peck, C.H. 1892. Annual report of the State Botanist (1891). Report N.Y. State Mus. 45 (Bot. ed.): 17-42.

Peck, C.H. 1896. Annual report of the State Botanist (1895). Report N.Y. State Mus. 49 (Bot. ed.): 1-70.

Pegler, D.N. and T.W.K. Young. 1987. Classification of *Oudemansiella* (Basidiomycota: Tricholomataceae), with special reference to spore structure. Trans. Brit. Mycol. Soc. 87: 583-602.

Pilát, A. 1951. Klic. K Urcovani nasich hub Hribovitych a Bedlovitych. Agaricales. Agaricalium Europeaeorum Clavis Dichotomica. Brazda, Praha.

Rayner, R.W. 1970. A mycological colour chart. Commonwealth Mycological Institute, Surrey.

Redhead, S.A. 1987. The Xerulaceae (Basidiomycetes), a family with sarcodimitic tissues. Can. J. Bot. (in press).

Ridgway, R. 1912. Color standards and color nomenclature. By author, Washington.

Singer, R. 1945. New and interesting species of Basidiomycetes. Mycologia 37: 425-439.

Singer, R. 1986. The Agaricales in Modern Taxonomy, 4th rev. ed. Koeltz Scientific Books, Koenigstein.

Smith, A.H. 1949. Mushrooms in their natural habitats. Sawyer's Inc., Portland.

Szczepka, M.Z. and S. Sokol. 1986. The development strategy of *Xerula melanotricha* Dorfelt (Basidiomycetes, Agaricales). Int. J. Mycol. Lichenol. 3: 125-133.

MYCOTAXON

Vol. XXX, pp. 407-416 October-December 1987

A NEW SPECIES AND A NEW COMBINATION IN CERCOPHORA

Richard T. Hanlin

Department of Plant Pathology
University of Georgia
Athens, Georgia 30602 USA

and

Omar Tortolero

Posgrado en Fitopatologia
Universidad Centro Occidental "Lisandro Alvarado"
Barquisimeto, Venezuela

ABSTRACT

Among ascomycetes collected in Venezuela is a new species of *Cercophora*, *C. palmicola*, from decaying palm stems. Comparison of *C. palmicola* with type material of *Lasiosphaeria subambigua v.* Höhnel, from palm stems in Brazil, demonstrated that the two fungi are not conspecific. On the basis of ascospore characteristics, *L. subambigua* is considered to be better accommodated in *Cercophora*, so the new combination *Cercophora subambigua* (v. Höhnel) Hanlin et Tortolero is proposed.

Keywords: Ascomycetes, pyrenomycetes, Sordariales, palm, Brazil, Venezuela.

RESUMEN

Entre los ascomicetos recolectados en Venezuela es una especie nueva de *Cercophora*, *C. palmicola*, proveniente de tallos podridos de palma. Al comparar *C. palmicola* con el holotipo de *Lasiosphaeria subambigua* v. Höhnel, de tallos de palma en Brasil, se demonstró que los dos hongos son diferentes. Tomando como base las caracteristicas de las ascosporas, consideramos que *L. subambigua* se arreglaría major en el género *Cercophora*, de manera que se propone la nueva combinación *Cercophora subambigua* (v. Höhnel) Hanlin et Tortolero.

While collecting plant pathogenic fungi in Venezuela, an unfamiliar perithecial ascomycete was encountered on decaying palm stems. Examination of this fungus showed it to possess ascospores that varied in shape, from unicellular and cylindrical when young, to two-celled at maturity, with a curved, hyaline lower cell and an enlarged, brown upper cell. These characteristics place this fungus in *Cercophora*, a genus of sordariaceous fungi that commonly occur on dead wood and dung. Comparison of this specimen with published species descriptions in the genus reveal that it differs from them in several characteristics. Consequently, we regard it as a new species, which is described below.

Cercophora palmicola Hanlin et Tortolero, species novum

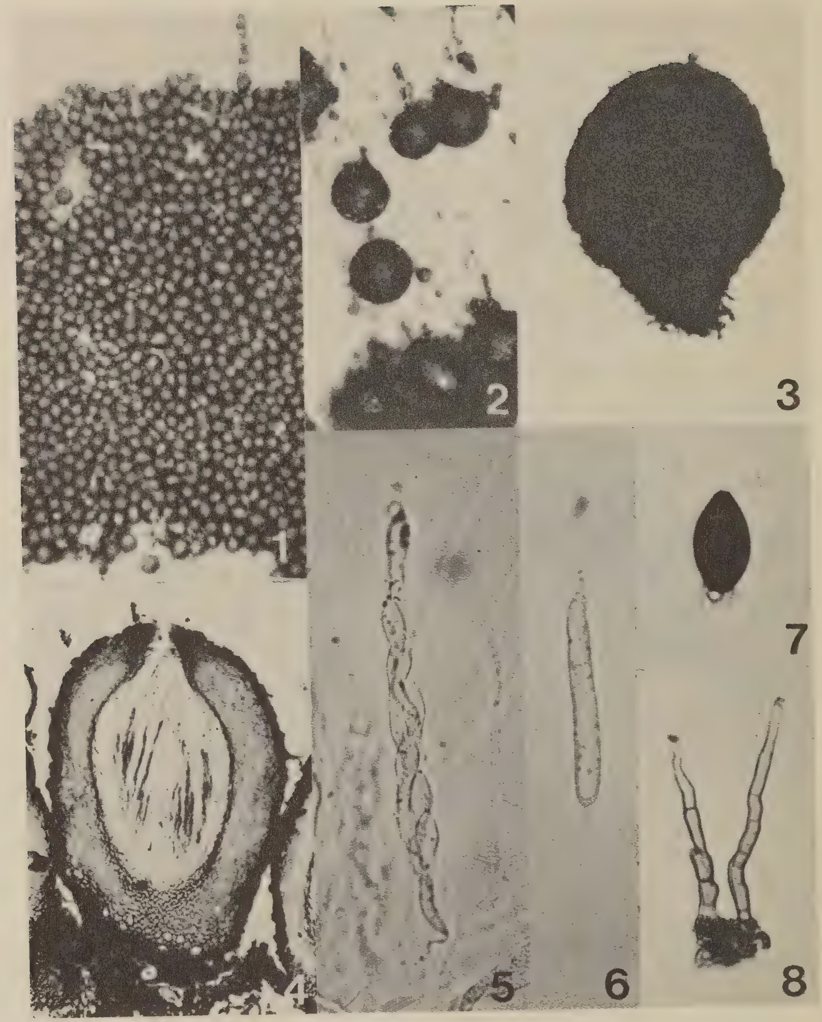
Perithecia superficiaria, plerumque aggregata, atrata, turbinata, ostiolata, cum papilla brevi; pili peritheciorum atrobrunnei, breves, septati, angustati apicem versus, dispersi, separati vel fasciculati, usque ad 60 µm longi X 4-6 µm lati. Paries perithecii crassus, 'pseudobombardoideus', ex cellulis crassissimis compositus. Paraphyses septatae, juveniles filiformes, vetustates vesiculatae. Asci unitunicati, anguste clavati, angustati basem versus, cum annulo apicali, (150)-156-(164) X 10 µm. Ascosporae juveniles unicellulares et cylindratae, utrinque caudatae

gelatinosae, (36)-47-(56) µm longae, vestutates bicellulares, cellula superior aucta et brunnea, (6)-9-(12) µm lata, cellula inferior curvata, 5-7 µm lata, interdum fatiscens.
Ad caulium putrescentium Palmae.

Holotypus: Venezuela, propinquus Sanare, Lara, R. T. Hanlin (#580), A. Carrasco, & B. Jiménez, Februarius 9, 1983 (in VEN); Isotypus in GAM (#12701).

Etymology: Latin, palma (the substrate, palm) + -cola (dweller, dwelling on).

Ascomata superficial, densely crowded on surface of substrate (Fig. 1), occasionally separate (Fig. 2). Ascoma a black perithecium, turbinate (Fig. 3), sometimes broadly obovoid due to crowding, often with a truncate base, (395)-525-(672) µm high X (324)-396-(474) µm wide, ostiolate, with a short papilla; ascoma bearing short, rigid, septate, tapered hyphae scattered on surface (Fig. 8), up to 60 µm long X 4-6 µm wide, separate or in fascicles, dark brown, with lighter tip cell. Ascoma wall thick, pseudo-bombardioid (Fig. 4), outermost cells pseudoparenchymatous, with dark-brown walls; cells of middle layer thick-walled and subhyaline to yellowish; cells of inner layer flattened, with lightly pigmented walls. Centrum rounded at base. Paraphyses hyaline, septate, filamentous when young (Fig. 5), becoming vesiculose and tapered toward the apex when older. Asci unitunicate, narrowly clavate, tapered at the base (Fig. 5), with a nonamyloid apical ring, (150)-156-(164) X 10 µm. Ascospores initially one-celled and cylindrical, with a long, slender, gelatinous appendage at each end (Fig. 6), the upper half of the ascospore swelling and delimited by a septum; the lower cell becoming curved but not enlarging. Septum sometimes forming in lower cell. Two-celled ascospores (36)-47-(56) µm; upper cell (14)-21.7-(30) µm long X (6)-9-(12) µm wide; lower cell 5-7 µm in width. Upper cell becoming dark-brown (Fig. 7), lower cell remaining hyaline and often disintegrating. Pigmented spores then appearing one-celled, with a pointed apex and truncate base. Ascospores capable of germinating from both ends while still unpigmented. Brown ascospores not common in our material.



Figs. 1-8. *Cercophora palmicola*. 1. Densely crowded ascomata on node of palm stem, X8. 2. Close-up of isolated ascomata, X20. 3. Side view of ascoma, X86. 4. Section through ascoma, X98. 5. Ascus with immature ascospores with a gelatinous appendage at each end, X700. 6. Newly delimited ascospore, X500. 7. Mature ascospore; hyaline lower cell has disintegrated, X500. 8. Ascomal hairs, X400.

This fungus was collected on a decaying palm trunk in a wet forest at ca 1,500 m altitude along a highway south of Sanare, Edo. Lara.

Holotype: Venezuela, R. T. Hanlin (#580), A. Carrasco, & B. Jiménez, February 9, 1983 (in VEN); Isotype in GAM (#12701).

This is the second species of *Cercophora* to be reported from Venezuela. Chardon (1934) reported *C. coprophila* Lundqvist (1972) from cow dung in Mérida and Táchira [under the name *Pleurage albicans* (Alb. et Schw.) Griffin]. Cain (1934) and Dennis (1970) refer to this species as *Bombardia coprophila* (Fr.) Kirschstein.

Measurements of the ascomata and ascospores of *C. palmicola* are very similar to those published for *Lasiosphaeria subambigua* v. Höhnel, (Höhnel, 1907; Saccardo, 1913). Therefore, the holotype on deposit in the von Höhnel collection at FH (Holmgren et al., 1981) was examined. The type specimen consisted of two pieces of palm stem ca 20 X 2 mm, plus two microscope slides. The stem pieces were covered with dark mycelium bearing scattered ascomata. Because of the sparseness of material, observations were limited to examination under the dissecting microscope and the slides. The type packet also bore small drawings showing the shape of the ascomata and ascospores. Examination of the type showed that it is not conspecific with *C. palmicola*. On the basis of our studies, we feel that *L. subambigua* is better accommodated in the genus *Cercophora*, so the following transfer is proposed.

Cercophora subambigua (v. Höhnel) Hanlin et Tortolero, comb. nov.
Basionym: *Lasiosphaeria subambigua* v. Höhnel (1907)

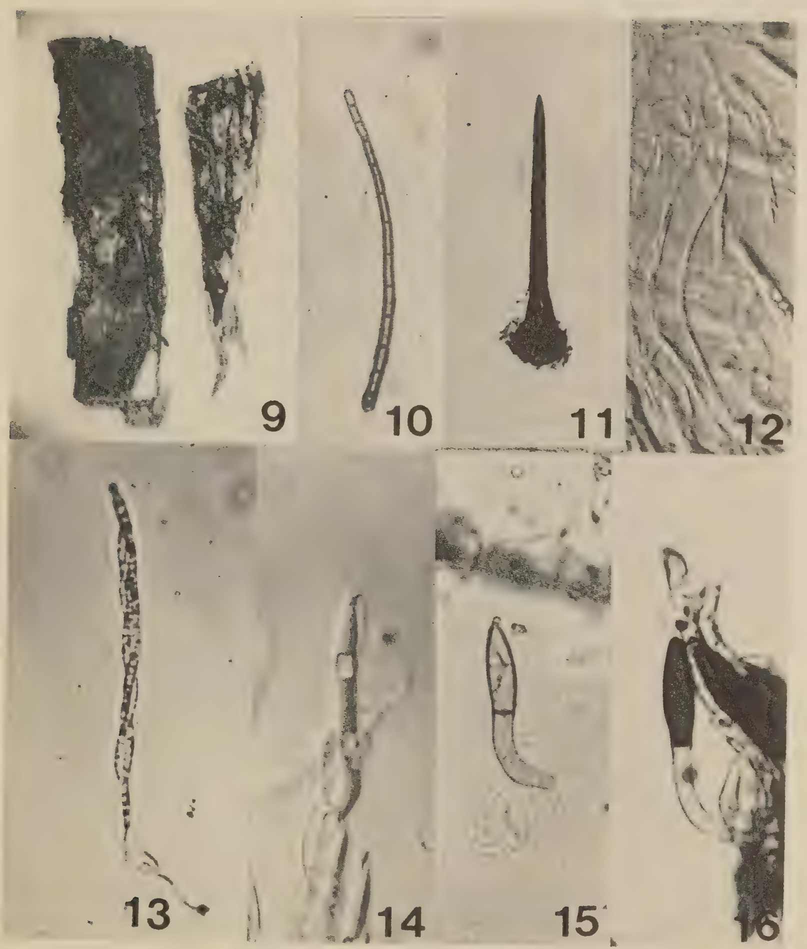
Since this species apparently has not been illustrated, photographs are included to supplement a translation of the original description in German (Höhnel, 1907), along with some additional observations.

"Perithecia superficial, growing like turf (Fig. 9), membranaceous-carbonaceous, oval, acutely conical and glabrous above, the rest densely covered with setae, some black, stiff, opaque, pointed (Fig. 11), up to 120 µm long, 7-12 µm thick at the base, some translucent-brown, septate, up to 160 X 6 µm large, toward the base and on the base provided with decumbent, brown, septate hyphae (Fig. 10), 4-6 µm wide, 350-400 µm wide, 500-600 µm high. Paraphyses numerous, long-threadlike (Fig. 12), mucilaginous. Asci clavate, long-stalked (Fig. 13), 140-180 X 8, 8-spored, truncate above with a clear center. Spores 2-ranked, hyaline in the ascus, vermiform-curved, one-celled (Fig. 14), they mature outside, 2-4-celled (Fig. 15), in the upper part 1-2-celled, ellipsoidal, swollen and brown (Fig. 16), in the lower part vermiform, curved, subhyaline, with a short, hyaline appendage at both ends, 40-44 X 4-5 µm.

On a rotten palm stem together with *Lasiosphaeria ovina*. São Paulo, Alto da Serra prope Santos." Holotype: No. 3069, v. Höhnel Collection, FH.

Etymology: Latin, sub- (somewhat) + ambigua (ambiguous), referring to its similarity to *Lasiosphaeria ambigua* Sacc.

Cercophora palmicola and *C. subambigua* differ in several respects; these differences are summarized in Table 1.



Figs. 9-16. *Cercophora subambigua*. 9. Type specimen from FH, X2. 10. Hyphal ascomal hair, X354. 11. Ascomal seta. Note bulbous base, X800. 12. Filamentous paraphysis, X365. 13. Ascus with immature ascospores, X646. 14. One-celled ascospore, X471. 15. Two-celled, immature ascospore, X1000. 16. Mature ascospore, X1067.

One of the most distinctive features of *C. palmicola* is the thick, pseudo-bombardioid ascomal wall, a characteristic it shares with *C. albicollis* Lundq., *C. elephantina* (P. Henn.) Lundq., and *C. scortea* (Cain) Lundq. These species differ from *C. palmicola* in the

Table 1. Comparison of taxonomic characteristics of two species of *Cercophora* from palm stems.

	C. palmicola	*C. subambigua*
Habit	Ascomata form a dense layer on substrate; mycelium internal.	Ascomata seated on a dark mycelium on substrate.
Ascoma	Turbinate, with an ostiolar papilla.	Conical above, with an ostiolar neck.
Surface	Dark-brown, septate hairs scattered on surface, bases not enlarged.	Dense covering of pointed, dark-brown setae, enlarged at base; also bears longer, brown septate hairs.
Ascospores	Cylindrical and one-celled when young, with gelatinous appendage at each end. Mature spore 2-celled, upper cell wider and brown, lower cell curved and hyaline, sometimes disintegrating.	Young spore the same. In mature spore, brown upper cell often one-septate, lower cell subhyaline and persistent, sometimes septate.

shape of the ascoma and in their coprophilous habitat. Another distinctive feature of *C. palmicola* is the turbinate to broadly obovoid shape of the ascoma. In other species of *Cercophora* the shape is described (Lundqvist, 1972) as obpyriform or ovoid to conical; the species most similar in ascoma shape is *C. gossypina* Lundqvist, which is subglobose to broadly ovoid. In *C. palmicola* the mycelium is scarcely evident on the substrate, and it is often obscured by the closely crowded ascomata that form in bands on the nodes. In *C. subambigua,* however, the mycelium forms a tangled mass of black hyphae on the substrate, with the ascomata scattered on the surface of the mycelium. Saccardo (1913) described in the habit of *L. subambigua* as "gregariis' (gregarius, crowded), but von Höhnel's (1907) characterization of "rasig wachsend" (growing like turf) is more accurate. Under reflected light the setae of *C. subambigua* appear shiny and black, but under transmitted light they are dark brown and thick walled.

According to Müller and von Arx (1973), the fungi described here would be placed in *Lasiosordaria,* a genus that Lundqvist (1972) considers a nomen illigiticum. As distinguished by Lundqvist, in *Lasiosphaeria* the ascospores are never pigmented and usually lack gelatinous appendages, whereas in *Cercophora* the ascospores are both pigmented and appendaged. *Cercophora* is distinguished from *Podospora* by its curved lower cell and the tendency of *Cercophora* ascospores to germinate in the unpigmented stage. In *Bombardia* the wall is 5-layered (bombardioid), and the perithecium tapers acutely at the base, which is dark and carbonaceous. On the basis of these characteristics, we feel that the two species described in this paper are best accommodated in *Cercophora*.

ACKNOWLEDGMENTS

We thank R. G. Roberts for assistance in searching the taxonomic literature, the curators of FH for loan of material, and Christine Roesch for checking the translation from the German. The manuscript was reviewed by E. S. Luttrell, C. W. Mims, and R. G. Roberts. This study was funded in part by NSF Grant INT-8501713 and CONICIT Proyecto S1-1435.

LITERATURE CITED

Cain, R. F. 1934. Studies of coprophilous Sphaeriales in Ontario. Univ. Toronto Stud., Biol. Ser. 38: 1-126.

Chardon, C. E. 1934. Fimetariales. pp. 177-179. In C. E. Chardon and R. A. Toro. Mycological explorations of Venezuela. Monogr. Univ. Puerto Rico, Ser. B., 2: 1-353.

Dennis, R. W. G. 1970. Fungus flora of Venezuela and adjacent countries. Kew Bull. Addl. Ser. III. 531 p.

Höhnel, F. von 1907. Eumycetes et Myxomycetes. Published as a separate by Alfred Hölder, Wien. Part of Denkschr. Akad. Wiss. Wien 83: 1-46, 1927.

Holmgren, P. K., W. Keuken, and E. K. Schofield. 1981. Index Herbariorum. Part 1., ed. 7. The herbaria of the world. Regnum Vegetabile 106: 1-452.

Lundqvist, N. 1972. Nordic Sordariaceae s. lat. Symb. Bot. Upsal. 20(1): 1-374.

Müller, E., and J. A. von Arx. 1973. Pyrenomycetes: Meliolales, Coronophorales, Sphaeriales. p. 87-132. *In* G. C. Ainsworth, F. K. Sparrow, and A. S. Sussman. The Fungi. Vol. IVA. A taxonomic review with keys: Ascomycetes and Fungi Imperfecti. Academic Press, New York. 621 p.

Saccardo, P. A. 1913. Sylloge Fungorum. Vol. 22, p. 210. Publ. by author, Pavia. 1612 p.

MYCOTAXON

Vol. XXX, pp. 417-431 October-December 1987

PSEUDALEURIA QUINAULTIANA, A NEW GENUS AND SPECIES OF OPERCULATE ASCOMYCETE FROM THE OLYMPIC PENINSULA.

DEMARIS E. LUSK*

Dept. of Botany & Plant Pathology, Oregon State
University, Corvallis, Oregon 97331

SUMMARY

Pseudaleuria quinaultiana gen. et sp. nova is an operculate ascomycete and therefore in the order Pezizales. It is further placed in the Pyronemataceae, tribe Aleurieae. Morphological characteristics suggest that it is most closely related to *Aleuria*.

INTRODUCTION

Pseudaleuria quinaultiana gen. et sp. nova was discovered on the Olympic Peninsula of North America. The peninsula is the extreme northwest corner of the continental United States, in the state of Washington. Much of this area is temperate rainforest that receives at least 250 cm precipitation per year, and has moderate temperatures. The region has shallow, stoney, mountain soils, and coniferous vegetation (USDA, 1975).

The only discomycete flora of this area was prepared by B. Kanouse. From Olympic Peninsula collections Kanouse and A. H. Smith described 3 new genera and 12 new species (Kanouse & Smith, 1940; Kanouse, 1941, 1944, & 1947). None of those fungi resemble the fungus which is described here.

---

* Currently at the Dept. of Botany, University of Florida, Gainesville, Florida, 32611.

Materials & Methods

The first collections of *P. quinaultiana* were made mid-May 1983. Additional collection trips were taken in May 1984, September 1984, May 1985, and May 1986.

Microscopic observations of both sections and crush mounts were made. Fresh material for sectioning was preserved in FAA, embedded in parafin, sectioned at 12 micrometers, and stained with safranin and fast green (Johansen, 1940). Both fresh and rehydrated material was employed in crush mounts. Dried material was revived in either 10% ammonium hydroxide, 2% KOH, or tap water for 15-30 minutes. Congo red followed by 2% KOH, cotton blue in lactic acid with heat, Meltzer's solution, and fuelgen stains were used on crush mounts to study various aspects of the fungus' micromorphology. Additionally, crush mounts of fresh material were washed with concentrated sulfuric acid to confirm the presence of carotenoid pigments (Johansen, 1940).

Cultures grown on corn meal-malt-yeast agar (CMMY, Denison & Carlstrom, 1968), potato dextrose agar (PDA), malt agar, and cooked rye grain (Stamets & Chilton, 1983), were examined for anamorph production. These cultures were prepared by shooting ascospores from fresh apothecia on to malt agar, then making transfers to PDA, CMMY, and fresh malt agar soon after germination (24-72 hours). Prepared rye grains were inoculated with transfers from colonies on PDA plates. Both spore germination plates and cultures from transfers were stored at room temperature.

Cultures were prepared specifically for observation of spore germination and hyphal growth by shooting ascospores from fresh apothecia on to PDA and PDA with 500 ppm streptomycin (PDAS), then incubating these plates at 20° C with 12 hour light and dark periods. Observations were made at 12 hour intervals for the first 3 days, and 24 hour intervals for 5 more days. Tissue explants were also prepared for observation of hyphal growth and sclerotia formation. About 1 x 1 mm squares of apothecia were surface sterilized for 5 minutes in 10% Chlorox then rinsed for 5 minutes in sterile distilled water before placement on PDA plates. These explants were incubated at 20° C with 12 hour light and dark periods, and observed daily for 4 weeks.

P. quinaultiana's ability to form a mycorrhizal association with *Pinus ponderosa* Dougl., and *Pseudotsuga menziesii* (Mirbel) Franco was tested. Methods used in mycorrhiza synthesis tests are those outlined by Molina and Palmer (1982).

DESCRIPTIONS

Pseudaleuria Lusk, *gen. nova.*

Apothecia sparsa vel fasciculata, mediocria, sessilia vel substipitata, orbicularia vel repanda; hymenio clare rubro-aurantiaco, extus similari vel pallidiore, pilis hyalinis, flexuosis, stratum externum velutinum tormantibus; excipulo duobus stratis composito, strato interiore ex textura intricata, strato exteriore ex textura angularis, ascis operculatis, non amyloideis, octosporis, cylindraceis, basin versus sensim angustatis, ad maturitatem non prodtrudentibus, muro tenui; ascosporis ellipsoideis, laevibus, hyalinis, eguttulatis, mediocribus; paraphysibus gracilibus, sursum plus minsve dilatatis, raro ramificantibus.

Typus: Pseudaleuria quinaultiana Lusk, *sp. nova.*

Apothecia scattered or in clusters, medium sized, sessile to substipitate, discoid to repand, thick-fleshed, texture firm fleshy to rubbery, becoming corky when dry; hymenium bright reddish orange; exterior concolor or lighter when fresh, with flexuous hyphoid hairs, these hairs forming a felty layer; excipulum two-layered, medullary layer is *textura intricata*, ectal layer is *textura angularis*; asci operculate, non-amyloid, eight-spored, cylindrical, tapering to the base, thin-walled, not protruding at maturity; ascospores ellipsoid, smooth, hyaline, eguttulate, uninucleate, medium sized; paraphyses slender, slightly to greatly and abruptly enlarged above, rarely branching.

Soil and/or wood saprobe, or mycorrhizal. Thus far, only known from the Olympic Peninsula, Washington State, U.S.A.

Type species: *Pseudaleuria quinaultiana* Lusk, *sp. nova.*

Pseudaleuria quinaultiana Lusk, *sp. nova.*

Apothecia sparsa vel fasciculata, mediocria (0.7-3.5 cm *lata,* 0.5-1.5 mm *crassa*)*, sessilia vel substipitata, orbicularia vel repanda, hymenio clare rubro-aurantiaco, extus similari vel pallidiore, pilis hyalinis, flexuosis, stratum externum velutinum tormantibus* (*vel* 260 um *crassa*)*; excipulo ex duobus stratis composito, strato interiore ex* *textura intricata* (155-770 um *crassa*), *strato exteriore ex textura angularis*, (100-115 um *crassa*); *ascis operculatis, non amyloideis, octosporis, cylindraceis* (200-300 x 8.0-12.5 um), *basin versus sensim angustatis, ad maturitatem non protrudentibus, muro tenui; ascosporis ellipsoideis, laevibus, hyalinis, eguttulatis, mediocribus* (15.5-19.5 x 7.5-10.5 um); *paraphysibus gracilibus* (240-320 um *lata*, 2.0-3.5 um *crassa*), *sursum plus minusve dilatatis* (4.5-11.5 um *lata*, 4.5-9.5 um *crassa*), *raro ramificantibus, hyphae in cultura hyalinae adpresae; sclerotia sub pagina evolvens demum erumpens.*

Apothecia scattered or in clusters, medium sized (0.7-3.5 cm broad, 0.5- at least 1.5 mm thick), sessile to substipitate, centrally attached, discoid to slightly concave or repand, larger specimens frequently with a central depression, often with an enrolled margin, texture firm fleshy to rubbery, becoming corky when dry; hymenium bright reddish orange, Scarlet to Scarlet Red, drying to a dull reddish brown, Orange Rufus to Mahogany Red; exterior lighter to concolorous, with long flexuous, hyphoid hairs, hairs arising from external thick-walled cells of the excipulum, these hairs are compacted into a thick (up to 260 um) felty layer exterior to the ectal excipulum; medullary excipulum is 155-770 um thick, *textura intricata*, of septate hyphoid cells; ectal excipulum is 100-115 um thick, *textura angularis*, the outermost cell walls are thickened; asci are operculate, eight-spored, cylindrical, 200-300 x 8.0-12.5 um, tapering to the base, not protruding at maturity, maturing seriatim; ascospores ellipsoid, 15.5-19.5 x 7.5-10.5 um, smooth, eguttulate, uninucleate; paraphyses slender, 240-320 x 2.0-3.5 um, slightly to greatly and abruptly enlarged above, apicies 4.5-11.5 x 4.5-9.5 um, straight, containing carotenoid granules, septate, rarely branching, branching in top half; in all cultures hyphae were hyaline, appressed to the agar surface, no conidial anamorph was found; soft sclerotia are produced on PDA, CMMY, malt agar, and boiled rye grain cultures, on agar the sclerotia first appear below the surface and later erupt, sclerotia range from reddish brown to dark chocolate brown in color, variously shaped, largest dimension not greater than 2.5 mm. All collections were made near the butt end of fallen conifers, in temperate rainforests. It can fruit several consecutive years (at least 2-4) in the same location. Distribution appears to be limited to the Olympic Peninsula, Washington State, U.S.A.

Type specimens: holotype *P. quinaultiana* OSC 45,764, collected at Lake Quinault, Wa., T23N R9W Sec. 29, 1984; isotypes CUP 61,783, and NY; paratypes OSC 45,765, collected at Lake Quinault site, 1983, OSC 45,766, collected at Lake Quinault site, 1985, BPI 71,941, collected in the Olympic National Park east of Forks, Wa., T28N R11W Sec. 17, 1983, OSC 45,768, collected in the same section (17) though not the identical location as BPI 71,941 in the Olympic National Park, 1985.

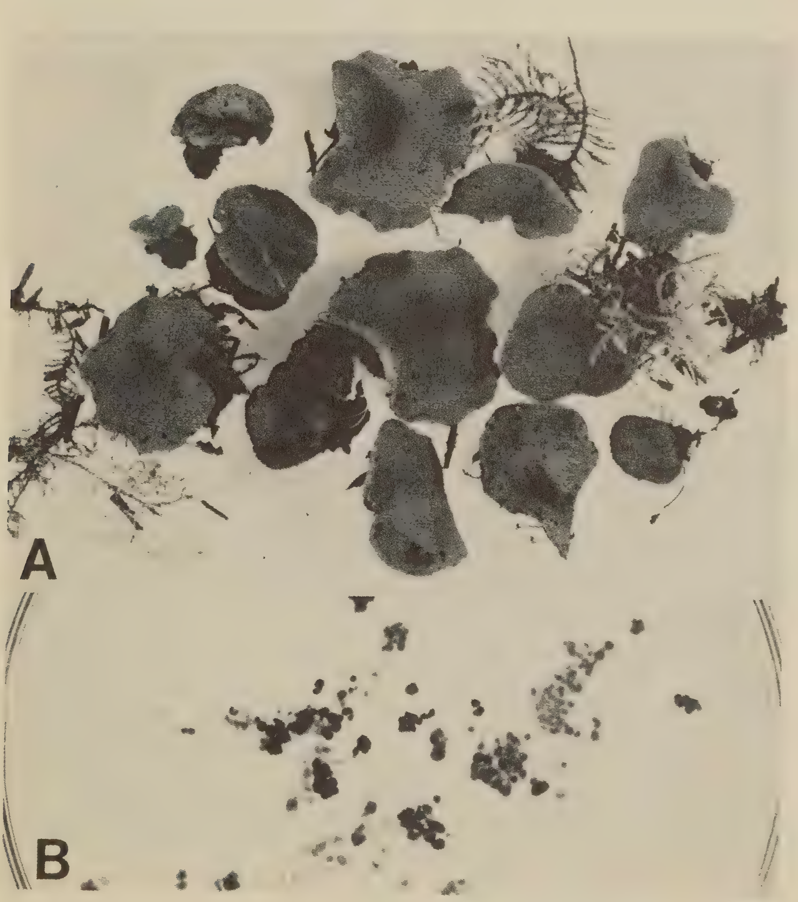


Fig. 1: *P. quinaultiana*, A. apothecia, holotype collection, 0.77X, B. culture with sclerotia, 1.2X.

DISCUSSION

Macromorphology & Pigmentation

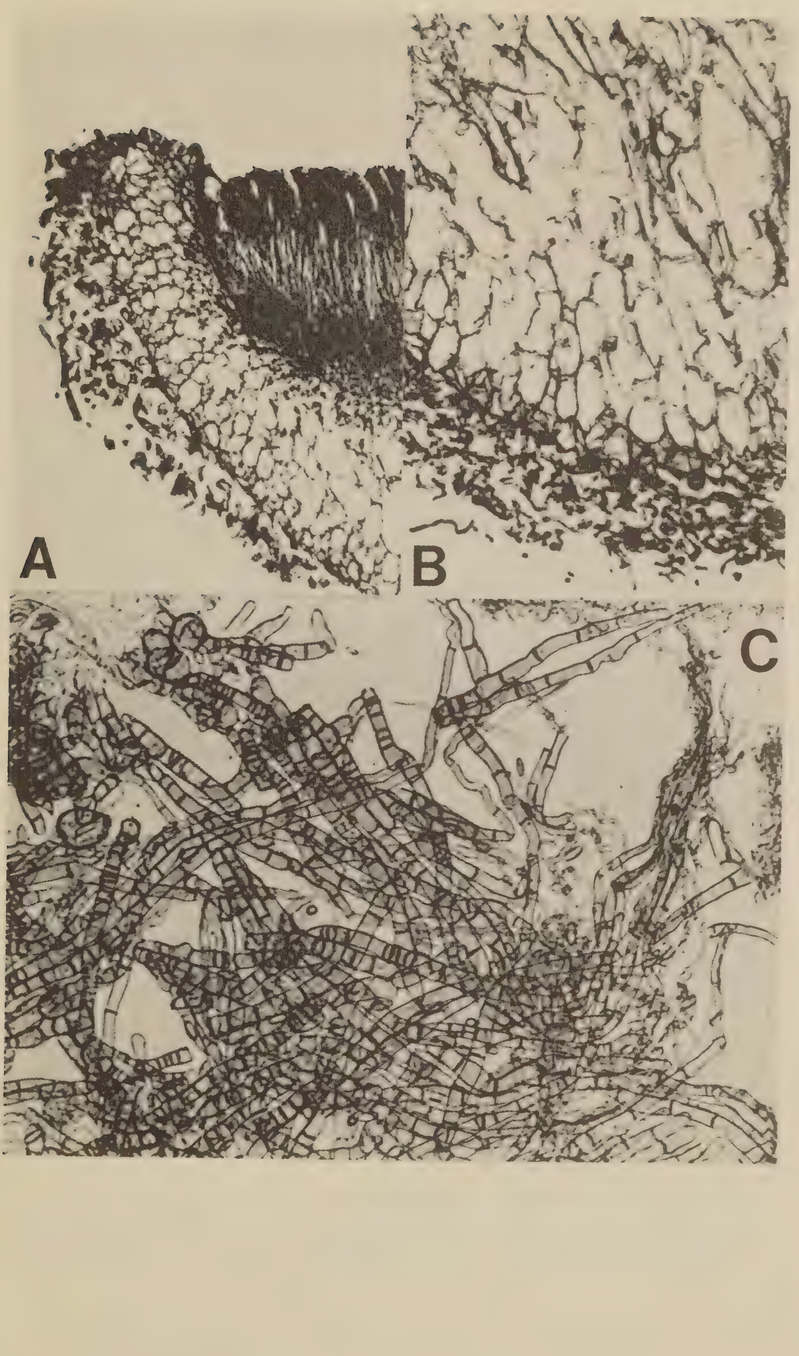
Of the Pacific Coast operculate fungi (Larsen & Denison, 1978) *P. quinaultiana* is most similar in external appearence to *Sarcoscypha coccinea* (Scoop. ex Fr.) Lambotte, and *Aleuria aurantia* (Ode. ex Fr.) Fuckel (Fig. 1A). *P. quinaultiana* is distinguished from *S. coccinea* in its lack of a stipe, and typically non-cupulate form. It is slightly more orange than *S. coccinea*, but this color difference is not great enough to be a good field identification character. *A. aurantia* and *P. quinaultiana* are similar in size and form, but the flesh of the former is thinner and more brittle than that of the latter. Pacific Coast *A. aurantia* are a bright orange while *P. quinaultiana* is distinctly red-orange.

P. quinaultiana is apparently similar in appearance to the very rare European fungus *Tricharina fibrillosa* (Currey) Yang & Korf. From those descriptions available (Yang & Korf, 1985; Dennis, 1972; Cooke 1879; Currey, 1863) *T. fibrillosa* has a more cupulate form, a more limited size range (although within the size range of *P. quinaultiana*), and is probably much more yellow than *P. quinaultiana*.

Hair Characteristics

The single most distinctive feature of *P. quinaultiana* is its apothecial hair (Fig. 2C). Its hairs are hyphoid, thin-walled, hyaline when fresh (sometimes darker when dry), arise from external thick walled cells, non-fasiculate, long (to at least 1 mm) and interwoven, and form an apparent layer external to the ectal excipulum (Fig. 2A & B). When fresh these hairs are so tightly interwoven that there is no evidence of them except at the margin even when viewed with a hand lens or disecting scope. The formation of this type of hair layer is unusual in the Pezizales. It is most closely approximated by some members of the Sarcoscyphaceae such as *Pseudoplectania nigrella* (Pers. ex Fr.) Fuckel (LeGal, 1953) and possibily by *Tricharina fibrillosa*. The hairs of *T. fibrillosa* are variously described as "marginal, in fascicles," by Yang & Korf (1985), "of two kinds, relatively thin-walled, closely septate, obtuse, brown hairs ... largely concealed by adpressed, matted

Fig. 2: *P. quinaultiana*, A & B. apothecial x-sections, stained with safranin & fast green, A. ca. 127X, B. ca. 153X, C. excipular hairs, squash mount in Congo Red, ca. 138X.


A
B
C

fibrils of much more slender hyaline hyphae" by Dennis (1972), and as "dingy-white downy fibrillae, which form a rather dense tomentose edging to the cup" by Currey (1863).

When hairs are present on *Aleuria* Fuckel, spp., they are hyaline, hyphoid, and thin-walled, but are never abundant (Korf, 1972). The closely related genus *Melastiza* Boud., has short, brown, hyphoid, thick-walled hairs (Korf, 1972; Eckblad, 1968). In this characteristic these genera are easily distinguished from *Pseudaleuria.*

Hair differences are often correlated with differences in other characteristics, and thus are of taxonomic value at the generic level (Eckblad, 1968). Therefore, *P. quinaultiana*'s unusual hair characteristics support the arguement for creation of the new genus.

The Excipulum

The excipular tissue combination *textura intricata* / *textura angularis* present in *Pseudaleuria* (Fig. 2A & B) is also found in at least some species of *Iodophanus* Korf, *Octospora* Hew. ex S.F. Gray, *Leucoscypha* Boud., *Scutellinia* (Cooke) Lamb., *Humaria* Fuckel, *Tricharina* (Boud.) Eckblad, *Sphaerosporella* (Svr.) Svr. and Kub., *Jafnea* Korf, *Aleuria*, *Geopyxis* (Pers. ex Fr.) Sacc., and *Anthracobia* Boud., (Eckblad, 1968). Although this tissue type combination is common in the Pyronemaceae (*sensu* Eckblad), the exact nature of the cells within each layer varies. Of those genera listed above, *Pseudaleuria* excipular tissues compare most closely with *Aleuria* tissues as seen in the line drawings of Rifai (1968).

Tricharina fibrillosa has the tissue combination *textura intricata* / *textura globulosa*, thus differing from *P. quinaultiana* in the ectal layer tissue type (Yang & Korf, 1985). They also differ in depth of the ental layer. The ental layer of the former being 90-112 micrometers (Yang & Korf, 1985) is much thinner than that of the latter which is 155-770 micrometers.

The excipular tissue combination of *Pseudaleuria* is distinct from that of *Sarcoscypha* (Fr.) Boud., which has an ectal layer of *textura porrecta* (Denison, 1972; Eckblad, 1968), and *Pseudoplectania* Fuckel, which is *textura intricata* throughout (Eckblad, 1968).

The Asci, Ascospores, & Paraphyses

Pseudaleuria asci are operculate. The wall at the apex appears uniform; there is no subapical pad discern-able with the light-microscope, although opercula of immature asci frequently appear caved in when material is rehydrated. The asci are not suboperculate, and therefore *Pseudaleuria* cannot be a member of the Sarcoscyphaceae. When comparing *Pseudaleuria* ascus characters to van Brummelen's (1981) ascus descriptions, they are most similar to *Aleuria* asci. The most frequently encountered difference between asci of these genera is the lateral or eccen-

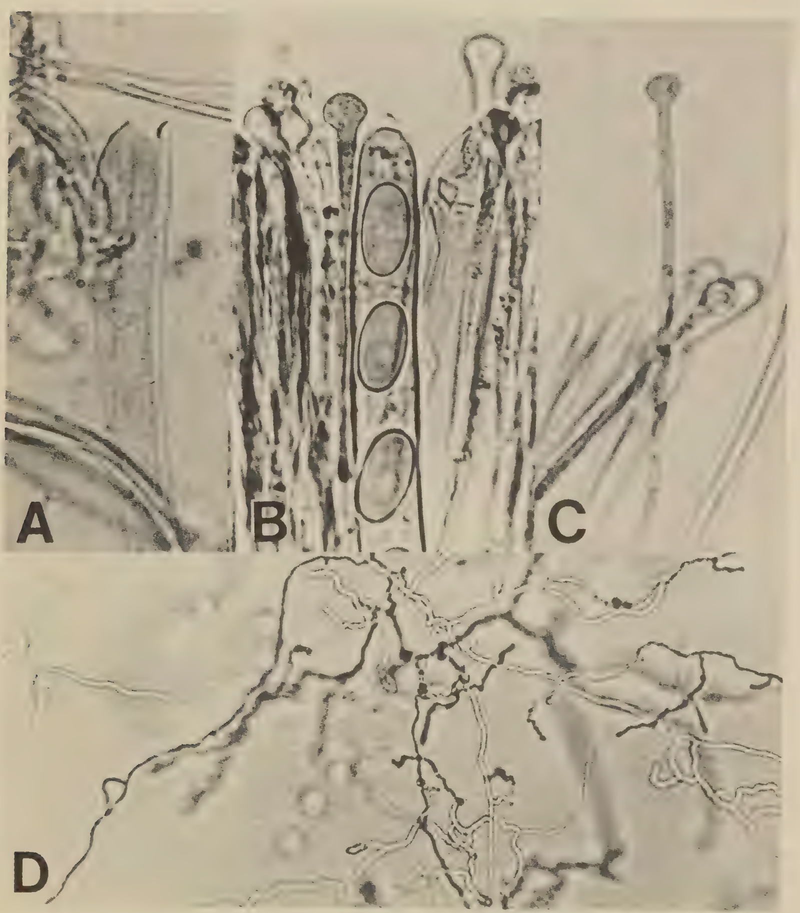


Fig. 3: *P. quinaultiana*, A. discharged ascus showing operculum, ca. 775X, B. ascus with ascospores, and paraphyses, ca. 775X, C. paraphyses, ca. 775X, D. hyphae growing on/in PDA, ca. 120X.

tric position of opercula in *Pseudaleuria* (Fig. 3A), generally not seen in *Aleuria*. This habit is more typical of the tropical Sarcoscyphaceous genera *Phillipsia* Berk., and *Cookeina* O. Ktze., (Denison, 1967, 1969, 1972).

Ascospores of *Pseudaleuria*, being smooth and eguttulate, are very unlike those of *Aleuria* and *Melastiza* which are ornamented and contain 1 or 2, usually 2 oil droplets (LeGal, 1947; Korf, 1972; Eckblad, 1968). Spore guttulation and ornamentation are considered of high taxonomic value at the generic level by Eckblad (1968). Therefore, these ascospore differences are a major reason for excluding *P. quinaultiana* from the genus *Aleuria*.

Ascospores of *Pseudaleuria* are uninucleate. All members of the Sarcoscyphaceae have 2 to 25 nuclei per spore (Kimbrough, 1970; Eckblad, 1968). Despite similarities in color, form and operculum placement, the uninucleate condition, asci with thin rather than thick walls, and lack of a suboperculate pad in *Pseudaleuria* exclude it from the Sarcoscyphaceae.

Paraphyses of *P. quinaultiana* (Fig. 3B & C) are similar to those of *Aleuria* spp. and *Tricharina fibrillosa*, all being swollen to some extent at the apex, and to *Aleuria* in containing granules. *T. fibrillosa* and *P. quinaultiana* both have a more abruptly swollen apex than *Aleuria*. Paraphysis characteristics are of little use in distinquishing these taxa.

Although the asci, ascospores, and paraphyses of *P. quinaultiana* are similar to those described for *Tricharina* (Yang & Korf, 1985), *P. quinaultiana* has been excluded from that genus. This exclusion is based on differences in hair characteristics, apothecial size, shape, color, and broadness of attachment to the substrate, ental layer thickness, branching pattern of the paraphyses, and cultural characteristics (Yang, personnal communication).

Habit & Ecology

Pseudaleuria quinaultiana has only been collected on the west slopes of the Olympic Peninsula to date (Larsen & Denison, 1978; Kanouse, 1947). In 1985 areas north of previously known sites, and the eastern slopes of the peninsula were checked, but no *P. quinaultiana* was found. This fungus's range is clearly limited, but whether this is due to geographic isolation or a specific habitat requirement(s) is not known.

All collections have been made near the butt end of fallen conifers. In all sites except one, enough time had passed since the tree fell for re-establishment of *Oxalis* L. spp., mosses, and liverworts. In 1983 collection BPI 71,941 was taken from a rock slide about 1-2 meters from a fallen tree, but fruiting was not observed during a follow-up visit to the site in 1985. Lack of fruiting is noteworthy in this case because the Lake Quinault site has fruited faithfully for 4 consecutive years. This suggests that the rock slide may lack some crucial element, environmental or otherwise, necessary for establishment of a perennial colony.

Some apothecia have been found on wood and others on soil. Without further study it is impossible to state conclusively that wood, or a disturbance site created by a fallen tree are requirements for the fruiting of *P. quinaultiana*. It is likely that this fungus is a decomposer. The possibility of it having a mycorrhizal association can not be excluded even though synthesis tests with *Pseudotsuga menziesii*, and *Pinus ponderosa*, failed to produce such an association.

Fruiting of *P. quinaultiana* coinsides with the spring fruiting of *Aleuria aurantia*. The Lake Quinault *P. quinaultiana* site was checked during the fall 1984 fruiting of *A. aurantia* on the peninsula, but no *P. quinaultiana* apothecia were found. This suggests that *P. quinaultiana* fruits only in the spring.

Culture

Ascospores of *P. quinaultiana* germinate readily on media such as malt agar, PDA, and PDAS. On PDA ascospore germination was first observed (much less than 0.1%) after 24 hours incubation. After 48 hours incubation the germination rate had increased to 0.2%, and by 70 hours ascospore germination was obscured by hyphae. During the interim between 24 and 70 hours percent germination did not increase appreciably. Ascospore germination on PDAS plates was first observed after 12 hours incubation. By 24 hours incubation about 2.2% germination was observed. At 48 hours the ascospores were overgrown with hyphae, again without appreciable increase in germination during the interim.

The radial growth rate of hyphae on PDA ranged from 0.5 cm per day for newly germinated ascospores to about 1.0 or 2.0 cm in diameter per day for colonies established from tissue explants and culture transfers. The hyphae do not grow out straight but are rather kinky and twisted, sometimes forming small knots (Fig. 3D). Hyphal growth is not limited to the substrate surface. A major portion of the colony is always submerged in the growth medium.

Although several media were tried, *P. quinaultiana* failed to produce a conidial anamorph in culture. Sclerotia (Fig. 1B) were produced by this fungus in and on all media tried. After 18 days growth on PDA at 20° C and 12 hour light and dark periods, sclerotia formation could be seen with the naked eye. They first appear as tiny off-white to cream colored dots, usually submerged in the medium. By 25 days growth sclerotia were often well developed having increased in size to as much as 2.5 mm in diameter, and aquiring a dark exterior pigment(s). Sclerotial formation is profuse in young cultures from ascospores or tissue explants, but seems to decrease with age of the culture. Production of sclerotia is uncommon in the Pezizales. Sclerotia have been found in species of *Morchella* Dell. ex Fr., (Boudier, 1897; Gilbert, 1960), *Pyronema* Carus (Moore, 1962; Rosinski & Korf, 1954), and *Wynnea* Berk. & Curt., (Rosinski & Korf, 1954).

CONCLUSIONS

Taxonomic Placement

Pseudaleuria quinaultiana gen. et sp. nova is an operculate ascomycete and therefore in the order Pezizales. Although the color, macromorphology, and regularly eccentric operculum of *P. quinaultiana* might lead one to conclude that this fungus is a member of the Sarcoscyphaceae, the nature of its operculum (lack of a suboperculate pad) and the number of nuclei per ascospore exclude it from that family.

Based on apothecial pigmentation and shape, spore nucleation, excipular construction, and operculum, *P. quinaultiana* is a member of the Pyronemataceae (*sensu* Korf, 1972), Pyronemaceae (*sensu* Eckblad, 1968), Humariaceae (*sensu* Rifai, 1968), Aleuriaceae (*sensu* Arpin, 1968).

Similarities in asci, excipular construction, paraphyses, and to a lesser extent apothecial size, shape, and color, suggest that *Pseudaleuria*'s most closely related genus is *Aleuria*. *Aleuria* ia a member of the Aleurieae tribe as described by Korf (1972) and Rifai (1968). *P. quinaultiana* also fits into that tribe based on those circumscriptions.

Taxonomic Validity

In the Pyronemataceae all sclerotia producing species known to date belong in the genus *Pyronema*. *Pyronema* apothecia are minute, and a recently sterilized substrate is necessary for fruiting (Moore & Korf, 1963). The species described here is not a member of that genus as described, and therefore must to a new species of another genus in that family.

This new species not only fits well into the Aleurieae tribe (*sensu* Korf, 1972) it has critical differences (usually hair, pigmentation, habit, or apothecial size) which exclude it from all other tribes described in the Pyronemataceae (Korf, 1972). None of the genera in the Aleurieae have the hair characteristics of this new species. This difference alone might be considered sufficent for erecting a new genus; however, here additional differences such as spore ornamentation and guttulation, substrate requirements, and apothecial size and shape exist. This new species does not fit well into any established genus, and therefore creation of a new genus for it is reasonable.

ACKNOWLEDGEMENTS

I thank the National Park Service and the Olympic National Park for their cooperation. Special thanks are extended to Dr. Kenton Chambers for his revision of and contributions to the Latin diagnosis, to Mike Castellano for his help with mycorrhiza synthesis tests, and to Chin Yang for his interest and sharing of data on cultural characteristics. I wish to express my gratitude to Dr. James Kimbrough, University of Florida, and to Dr. William Denison, Oregon State University, for their helpful comments and advise in review of the manuscript. Additional thanks are extended to Dr. Denison for his support and advise throughout this project. I acknowledge the Department of Botany and Plant Pathology at Oregon State University for their support, and Northwest Mycological Consultants for their financial assistance.

LITERATURE CITED

Arpin, N. 1968. Les Caroténoïdes des Discomycètes: Essai Chimiotaxinomique. Doctoral thesis. Université de Lyon, Villeubanne. 170 p.

Boudier, E. 1897. Analytique des morilles de France. Bull. Soc. Mycol. France 13:129-152.

Brummelen, J., van. 1981. The Operculate Ascus and Allied Forms. In Reynolds, D., (ed.) Ascomycete Systematics (The Luttrellian Concept). Springer-Verlon, N.Y. 27-48 p.

Cooke, M. C. 1879. Mycographia, I. Discomycetes. London.

Currey, F. 1863. VIII. Notes on British Cup Fungi. Trans. Linn. Soc. 24:151-160.

Denison, W. C. 1967. Central American Pezizales. II. The Genus *Cookeina*. Mycologia 59:306-317.

———. 1969. Central American Pezizales. III. The Genus *Phillipsia*. Mycologia 61:289-304.

———. 1972. Differentiation of Tribes and Genera in the Family Sarcoscyphaceae. Persoonia 6(4):433-438.

———, and R. C. Carlstrom. 1968. Ascocarp Development in *Leptosphaerulina argentinensis*. J. Elisha Mitchell Sci. Soc. 84(1):254-257.

Dennis, R. W. G. 1972. British Ascomycetes, 2nd ed. Cramer, Lehre. 585 p.

Eckblad, F.-E. 1968. The Genera of the Operculate Discomycetes: A Reevaluation of Their Taxonomy, Phylogeny, and Nomenclature. Nytt Mag. Bot. 15:1-191.

Gilbert, F. A. 1960. The Submerged Culture of *Morchella*. Mycologia 52:201-209.

Johansen, D. A. 1940. Plant Microtechnique. McGraw-Hill Book Co. N.Y. 532 p.

Kanouse, B. B. 1941. New and Unusual Species of Discomycetes. Mycologia 33:461-467.

———. 1944. A New Discomycete From the Olympic National Forest. Mycologia 36:460-463.

———. 1947. A Survey of the Discomycete Flora of the Olympic National Park and Adjacent Areas. Mycologia 39:635-689.

———, and A. H. Smith. 1940. Two New Genera of Discomycetes From the Olympic National Forest. Mycologia 32:756-759.

Kimbrough, J. W. 1970. Current Trends in the Classification of Discomycetes. Bot. Rev. (Lancaster) 36(2): 91-161.

Korf, R. P. 1972. Synoptic Key to the Genera of the Pezizales. Mycologia 64:937-994.

Larsen, Jr., H. J., and W. C. Denison. 1978. A Checklist of the Operculate Cup-Fungi (Pezizales) of North America West of the Great Plains. Mycotaxon 7(1):68-90.

LeGal. M. 1947. Recherches sur les Ornementations Sporales des Discomycètes Operculés. Ann. Sci. Natur.; Bot. Biol. Ver. (ser.11) 8:73-297.

LeGal, M. 1953. Les Discomycètes de Madagascar. Paris. 465 p.

Molina, R., and J. G. Palmer. 1982. Chapter 11. Isolation, Maintenance, and Pure Culture Manipulation of Ectomycorrhizal Fungi. In Schenck, N. C., (ed.) Methods and Principles of Mycorrhizal Research. The American Phytopathological Society, St. Paul, Minn.

Moore, E. J. 1962. The Ontogeny of the Sclerotia of *Pyronema domesticum*. Mycologia 54:312-316.

_______, and R. Korf. 1963. The Genus *Pyronema*. Bull. Torrey Bot. Cl. 90:33-42.

Rifai, M. A. 1968. The Australian Pezizales in the Herbarium of the Royal Botanic Gardens Kew. Ver. Kon. Ned. Akad. Wetensch., Afd. Natuurk. Tweede Sect., 58(3):1-295.

Rosinski, M. A., and R. Korf. 1954. Sclerotia in an Operculate Discomycete. Science 119:737.

Stamets, P., and Chilton. 1983. The Muchroom Cultivator. Agarikon Press, Olympia, Washington.

United States Department of Agriculture. 1975. Soil Survey of Jefferson County Area, Washington. USDA, Soil Conservation Service in Cooperation with Washington Agricultural Experiment Station.

Yang, C. S., and R. Korf. 1985. A Monograph of the Genus *Tricharina* and a New Segregate Genus, *Wilcoxina* (Pezizales). Mycotaxon 24:467-531.

MYCOTAXON

Vol. XXX, pp. 433-437 October-December 1987

A New Species of **Aleurodiscus** from Colorado

J. Page Lindsey
Fort Lewis College Biology Department
Durango, CO 81301

SUMMARY

Aleurodiscus mesaverdensis is described as new from Colorado. It differs from other **Aleurodiscus** species in its large spores, 4-sterigmate basidia, and lack of pseudocystidia. Cultural characters and Nobles Species Code are provided.

Aleurodiscus mesaverdensis is described as new. Fertile specimens were collected in Mesa Verde National Park in November, 1986 and May, 1987. The specimens threw mass spore deposits when revived in moist chambers in the cold. Cultures were grown as described by Nobles (1965) on Nobles Malt Extract Agar (NMEA), Gallic Acid Agar (GAA) and Tannic Acid Agar (TAA). Gum guiaic solution (GGS) was also used to test for presence or absence of polyphenoloxidases. Camera lucida drawings were made with an Olympus LHB microscope. Microstructure of basidiocarps and cultures was examined and described in 3% KOH plus aqueous phloxine and in Melzer's Reagent. Coded color names are from Munsell (1976). Collections of the author are identified as JPL; the RLG collection is from Robert L. Gilbertson.

Aleurodiscus mesaverdensis Linds. sp. nov. (Fig. 1)

Fructificatio orbiculata, discoidea, perennis, 1-8 mm diam, viva albida ad cinerascens, in sicco brunneolo, laevis vel rimosa, in sectione usque ad 660 µm crassa; margo abruptus. Contextus monomiticus; hyphae subiculii fibulatae, tenuitunicatae, 2.5-5 µm diam; acanthophyses cylindracei, 5-7 x usque ad 100 µm; pseudocystidia nulli; basidia clavata, habens 4 sterigmata uli matura; basidiosporae hyalinae ovoido-ellipsoideae, laeves, amyloideae, 19-28 x 12-17 µm. HOLOTYPUS: ad corticem **Pinus edulis** Engelm., Mesa Verde National Park, Montezuma County, CO, USA, leg. J.P. Lindsey, no. 1815; in herb. Nat. Fungus Collections, Beltsville, MD, USA (BPI).

Basidiocarps perennial, pulvinate to cyphelloid, 1-8 mm diam, sometimes coalescing to appear effused, effused patches up to 25 mm; margin determinate, concolorous, often raised; up to 660 µm thick in cross-section, compact. Hymenial surface whitish when revived, drying smooth to rimose, golden-buff (2.5Y 8/2 to 10YR 7/4 to 10 YR 8/4).

Subicular hyphae monomitic, thin to slightly thick-walled, nodose-septate, 2.5-5 µm diam; acanthophyses abundant, up to 100 µm long, thick-walled at base, some developing from basidioles, aculeate portion thick-walled to solid, up to 70 µm long, golden in KOH, individual prongs 1 x 3 µm; pseudocystidia lacking; basidioles numerous, clavate,

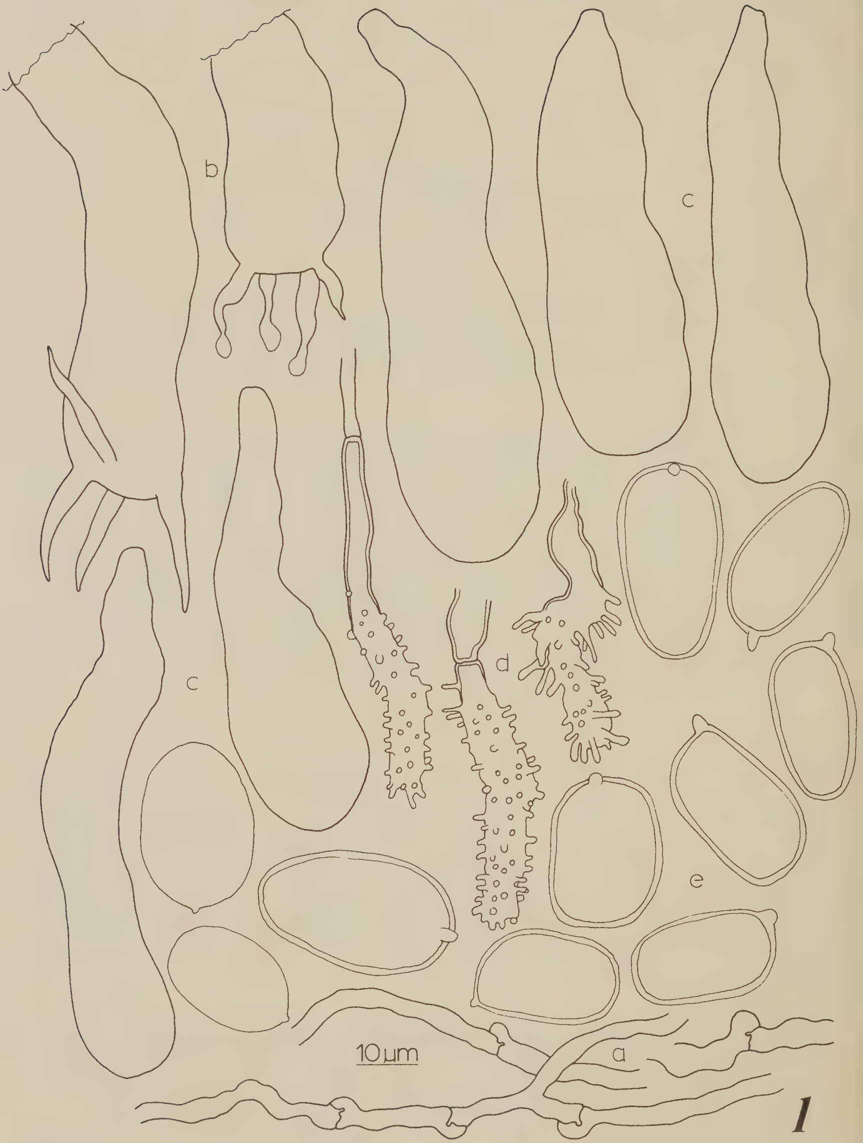


Fig. 1. **Aleurodiscus mesaverdensis** (JPL 1815). a) nodose-septate subicular hyphae; b) mature basidia; c) basidioles; d) acanthophyses; e) basidiospores.

slightly thick-walled, some developing into acanthophyses, 63-84 x13.5-22 µm; mature basidia clavate, 4-sterigmate, up to 17 x 70 µm, sterigmata 17 x 3 µm; basidiospores ovoid-ellipsoid, strongly but bluntly apiculate, smooth, becoming thick-walled, strongly amyloid in Melzer's reagent, 19-28 x 12-17 µm. Habitat: on bark on underside of living branches and trunks of **Pinus edulis** Engelm., especially common in drip lines.

This species is closest in microscopic morphology to **Aleurodiscus canadensis** Skolko, but it differs significantly in several ways. Notably, mature basidia of **A. canadensis** are mostly 2-sterigmate and measure 45-60 x 10-13 µm (Lemke, 1964). **A. canadensis** has pseudocystidia; these are lacking in **A. mesaverdensis**. Acanthophyses in **A. mesaverdensis** measure 28-100 x 6.5-9 µm and are rigid and strongly aculeate, whereas in **A. canadensis** they are more irregular in shape, more weakly aculeate, and shorter (27-38 µm). Basidiospores of the two species are similar in shape, but in **A. mesaverdensis** they range 19-28 x 12-17 µm, and in **A. canadensis** (10-)12-18 x (7-)9-13 µm (Fig. 2).

Macroscopically, **A. canadensis** is corticioid and 60-150 µm thick in cross-section (Lemke, 1964). **A. mesaverdensis** is pulvinate to

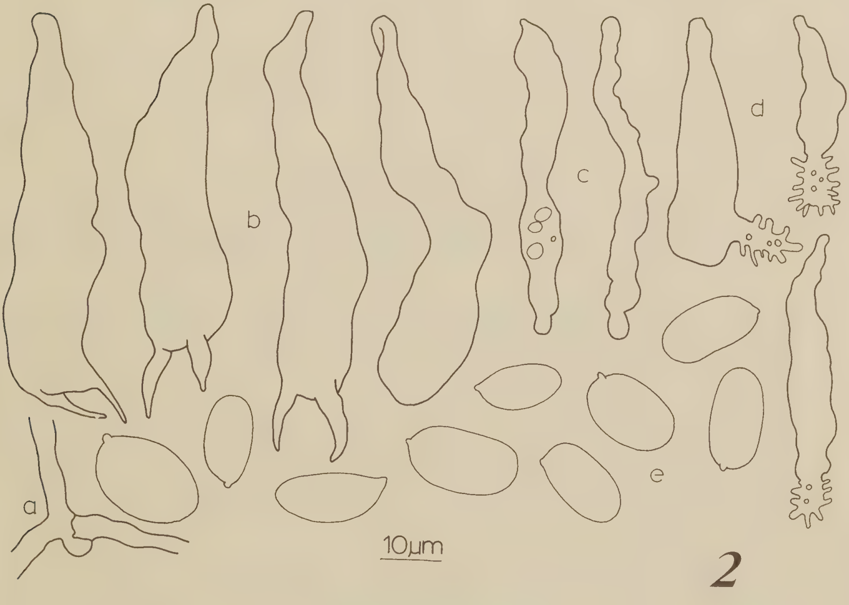


Fig. 2. **Aleurodiscus canadensis** (DAOM 163895). a) nodose-septate subicular hypha; b) mature basidia; c) pseudocystidia; d) acanthophyses; e) basidiospores.

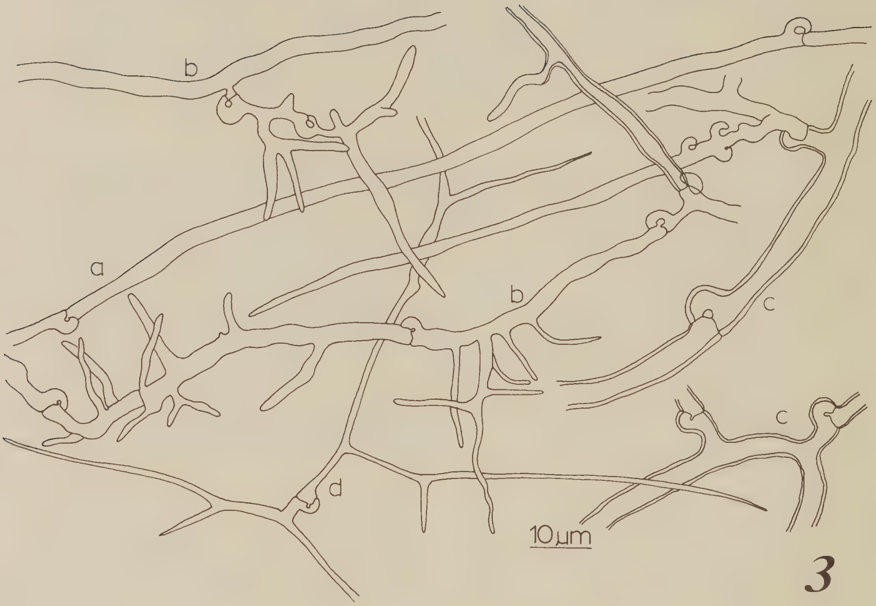


Fig. 3. **Aleurodiscus mesaverdensis** cultural characters (JPL 1815). a) unbranched hypha from advancing zone; b) profusely branching hyphae from immediately behind advancing zone; c) large diameter thick-walled hyphae from older part of culture (6 weeks); d) narrow fiber-like hypha from older part of culture (6 weeks).

cyphelloid, with larger basidiocarps approaching a stereoid habit; the largest basidiocarps observed approach 700 µm in thickness. **A. canadensis** colonizes dead limbs, mainly of spruce (esp. **Picea glauca** (Moench) Voss); **A. mesaverdensis** prefers living limbs of **Pinus edulis** Engelm. and has not yet been found in Colorado on another host. However, Gilbertson (1974) reported **A. canadensis** from **Pinus ponderosa** Laws. in southern Arizona, but examination of the specimen indicates that it more closely fits the microscopic characters of **A. mesaverdensis**. The Arizona collection is macroscopically scanty and thin and thus does not correlate well with descriptions of either species.

Specimens examined:

Colorado: on **Pinus edulis** Engelm., Wide View Ruin, Chapin Mesa, Mesa Verde National Park, Montezuma County, Nov. 20, 1986 (JPL 1815, HOLOTYPE); Wetherill Mesa, Mesa Verde National Park, May 18, 1987 (JPL 1820, 1821, 1822, 1823).

Arizona: **Pinus ponderosa** Laws., General Hitchcock Picnic Area, Santa Catalina Mountains, Coronado National Forest, Pima County, Oct. 31, 1969 (RLG 9318).

Cultural Characteristics

Voucher specimen: JPL 1815
Species code: 2.3.8.25.32.36.(37).38.47.50.55
Culture examined: JPL 1815 (Fig. 3)

Growth characters: Growth on NMEA about 6 mm per wk; after 6 wk radius 32-37 mm diam; margin even to bayed, hyaline, appressed to downy; mat white (becoming golden in older areas in some isolates), appressed, silky, smooth; reverse unchanged; odor sweet to pleasantly antiseptic; not fruiting in 6 wk; negative to weakly positive in GGS; diffusion zones on GAA 20 mm diam, on TAA 20 mm diam, no growth on either medium.

Microscopic characters: Hyphae of advancing zone thin-walled, hyaline, nodose-septate, unbranched, 2-2.5 μm diam; hyphae immediately behind advancing zone branching profusely from behind the clamp connections, hyaline, slightly thick-walled, 2.5-3 μm diam; hyphae near oldest part of culture (6 wk) of two types: a) thick-walled with lumen staining strongly in phloxine, abundant clamp connections, occasional simple secondary septa, 3.5-4.5 μm diam; b) thick-walled fiber hyphae with lumen not staining or without contents, clamp connections present but less frequent, branches becoming very slender and attenuated to almost hair-like, 1-1.5 μm diam.

Acknowledgements

I wish to thank the National Mycological Herbarium, Biosystematic Research Institute, Ottawa, Ontario, Canada, for loan of the isotype of **Aleurodiscus canadensis**; Dr. R.L. Gilbertson for critical review of the manuscript; and Mrs. Donna Giersch for typing the manuscript.

Literature Cited

Gilbertson, Robert L. 1974. Fungi that decay ponderosa pine. The University of Arizona Press, Tucson. 197p.

Lemke, P.A. 1964. The genus **Aleurodiscus (sensu stricto)** in North America. Can. J. Bot. 42:213-282.

Munsell Book of Color. 1976. Munsell Color Co., Inc. Baltimore, MD.

Nobles, Mildred K. 1965. Identification of cultures of wood-inhabiting Hymenomycetes. Can. J. Bot. 43:1097-1139.

MYCOTAXON

Vol. XXX, pp. 439-454 October-December 1987

SPECIES DIVERSITY OF AQUATIC HYPHOMYCETES IN FOUR AUSTRIAN STREAMS

BARBARA REGELSBERGER and KURT MESSNER

Institut für Biochemische Technologie und Mikrobiologie
Technische Universität Wien
Getreidemarkt 9, A-1o6o Wien, Austria

and

ENRIQUE DESCALS

Departament de Botanica, Facultat de Ciencies
Universitat de Barcelona, Spain
present address: Cases Noves, o719o Esporles, Mallorca

Summary

The aquatic hyphomycete flora of four streams in eastern Austria was investigated by water filtration and by examination of submerged decaying leaves and foam. All rivers investigated, although distinctly different in water chemistry and flow characteristics, proved to be very rich in species; a list of these is given. A significant number of conidia could not be identified and drawings are enclosed as some are of undescribed species.

Aquatic hyphomycetes are freshwater-borne fungi that - apparently in adaptation to living conditions in running water - produce branched or sigmoid conidia easily trapped on underwater substrates. Most of these fungi belong to the Fungi Imperfecti. They have been described from many different geographical locations, compiled by Webster & Descals (1981). There are, however, very few reports from streams in the Alps and the Danube valley although investigations by Ingold (1949) and Eggenschwiler & Bärlocher (1983) in the Swiss Alps as well as by Messner and Oberzill (1974) in the eastern Alps suggest a great abundance of aquatic hyphomycetes. This report is on a survey of species occurring in four rivers in eastern Austria, which differ in physico-chemical and flow characteristics.

Methods

Description of streams

Hardwater streams

The Ybbs is a typical hardwater stream of the northern limestone area of the eastern Alps: distinctly alkaline, with clear, rapidly flowing and rather cool water of high conductivity.

The Wulka, is a hardwater stream in the easternmost part of Austria draining the limestone Rosalien mountains and flowing through areas of intensive agriculture into lake Neusiedl (Neusiedlersee). The water has a high conductivity, is alkaline and warmer as well as richer in nutrients than the Ybbs. The Wulka is less turbulent and warms up in summer to more than 20°C.

Softwater streams

The Ysper is a typical softwater stream of the granite and gneiss area north of the Danube with clear, brown water of low conductivity and slightly alkaline pH. The brown colour is due to humic substances; the easily decomposable organic matter content is low. Espacially the upper part of the Ysper, where it flows through a wooded area with many waterfalls, seems to offer ideal conditions for aquatic hyphomycetes.

The Weitenbach is geographically very close to the Ysper and has a similar water chemistry but is more affected by urban and agricultural pollution.

Conductivity, pH and extrema of water temperature at sampling time as well as nitrate and phosphate values are given in table 1. The geographical location of the rivers is shown in figure 1. The riparian vegetation is dominated by deciduous trees such as **Acer, Quercus, Fagus, Salix** and **Alnus.**

Table 1 : Physico-chemical data of the four streams

	Hardwater		Softwater	
	Ybbs	Wulka	Ysper	Weitenbach
Temperature (°C)				
maximum	14	22	15	16
minimum	2	4	0,5	1
pH	8,2	8,1	7,3	7,4
Conductivity (µS/20°C)	300	800	65	85
NO$_3$ (mg/l)	1-4	5-6	5	10
PO$_4$ (mg/l)	0,01-0,1	0,2-3	0,03-0,08	0,3-1

(BMLF 1978,1979, Weninger, in press)

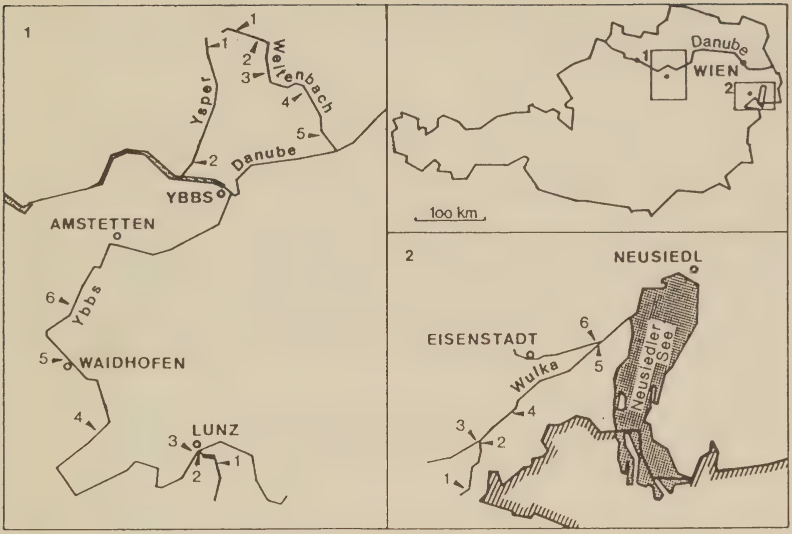


Figure 1: Geographical location of the rivers in Austria

Collection techniques

Samples were taken 1o times throughout one year at intervals of four to six weeks and at several sampling sites on each river.
Three techniques were used to investigate the fungal communities:

Examination of foam samples: Foam, when available, was collected in a small glass jar and fixed with 9o% alcohol. In the laboratory drops of foam were put singly on microscope slides, air dried, stained with cotton blue in lactic acid, covered and examined with bright-field and phase-contrast microscopy. Of each sample one or two slides were scanned.

Water filtration: Water was collected in plastic bottles and o,5% formaldehyde added for fixation. In the laboratory the water was filtered through 8 um membrane filters. The spores on the filter were stained with cotton blue in lactic acid, counted and identified under the microscope. 38 views of one filter, which was 1/5o of the filter area, were counted.

Examination of naturally colonized leaves: Submerged decaying leaves were collected randomly, rinsed under tap water, cut into squares and incubated in Petri dishes with distilled water for three to six days at room temperature (ca. 2o°C). The leaf and water surfaces and the bottom of the dish were scanned several times for conidia with a dissecting microscope. Two or three leaves were examined from each locality.

Results

The number of species of aquatic hyphomycetes found in the rivers investigated is surprisingly high. It is greater than in other rivers sampled by Bärlocher & Rosset (1981) and Eggenschwiler & Bärlocher (1983) in Switzerland and comparable to the numbers found by Shearer & Webster (1985) in England. A list of species encountered in the different streams is given in table 2. Unidentified spores are drawn in figures 2 to 9. The species list in table 2 results from all samples investigated.

Table 2: List of species encountered in the four streams
+ = present, o = absent
(citations in brackets refer to illustrations)

	Hardwater		Softwater	
	Ybbs	Wulka	Ysper	Weitenbach
1a. **Alatospora acuminata** Ingold sensu lato (Marvanová & Descals 1985)	+	+	+	+
1b. **Alatospora acuminata** Ingold sensu stricto (Marvanová & Descals 1985)	+	+	+	+
2. **Alatospora flagellata** (Gönczöl) Marvanová	+	+	+	+
3. **Alatospora pulchella** Marvanová	+	+	+	+
4. **Anguillospora crassa** Ingold (7E)	+	+	+	+
5. **Anguillospora furtiva** sp.ined. Webster & Descals (1979) (9ABC)	+	+	+	+
6. **Anguillospora longissima** (de Wildeman) Ingold (7F)	+	+	+	+
7. **Articulospora angulata** Tubaki (2E)	o	o	+	o
8. **Articulospora tetracladia** Ingold	+	+	+	+
9. **Camposporium pellucidum** Hughes	o	o	o	+
1o. **Campylospora ? chaetocladia** Ranzoni (2D)	+	+	o	o
11. **Clavariopsis aquatica** de Wildeman	+	+	+	+
12. **Clavatospora longibrachiata** (Ingold) S.Nilsson ex Marvanová & Nilsson	+	+	+	+
13. **Culicidospora aquatica** Petersen	+	o	+	+
14. **Culicidospora gravida** Petersen	+	+	+	+
15. **Dactylella aquatica** (Ingold) Tubaki	+	+	+	+
16. **Dendrospora erecta** Ingold	o	o	+	o

Table 2 continued	Hardwater		Softwater	
	Ybbs	Wulka	Ysper	Weitenbach
17. **Dendrospora ? fastuosa** Descals & Webster (7A)	o	o	+	o
18. **Dendrospora fusca** Descals & Webster	o	o	+	o
19. **Dendrospora nana** Descals & Webster	o	o	+	+
2o. **Dendrospora tenella** Descals & Webster	o	o	+	o
21. **Dendrospora torulosa** Descals & Webster	o	o	+	o
22. **Dwayaangam cornuta** Descals	+	+	+	+
23. **Flagellospora ? curvula** Ingold (7D)	+	+	+	+
24. **Geniculospora inflata** (Ingold) S.Nilsson ex Marvanová & Nilsson	o	+	o	o
25. **Gyoerffyella ? oxalidis** Vanev (3D)	o	+	+	+
26. **Gyoerffyella rotula** (v.Höhnel) Marvanová	o	o	+	+
27. **Heliscella stellata** (Ingold & Cox) Marvanová	+	+	+	+
28. **Heliscina campanulata** Marvanová	+	+	+	+
29. **Heliscus lugdunensis** Sacc.& Théry	+	+	+	+
3o. **Ingoldia biappendiculata** Arnold	o	o	+	+
31. **Isthmotricladia sp.** (6A)	o	o	+	+
32. **Lateriramulosa uni-inflata** Matsushima	o	o	+	+
33. **Lemonniera aquatica** de Wildeman	+	+	+	+
34. **Lemonniera terrestris** Tubaki	+	+	+	+
35. **Leptocladia neglecta** Marvanová & Descals	+	+	+	+
36. **Lunulospora curvula** Ingold	+	o	o	+
37. **Margaritispora ? aquatica** Ingold	+	+	+	+
38. **Monotosporella tuberculata** Gönczöl	+	+	o	o
39. **Mycocentrospora acerina** Newhall	+	+	+	+
4o. **Taeniospora gracilis** Marvanová	o	+	+	+
41. **Tetrachaetum elegans** Ingold	o	+	+	+
42. **Tetracladium furcatum** Descals	o	+	+	o
43. **Tetracladium marchalianum** de Wildeman	+	+	+	+
44. **Tetracladium maxilliforme** (Rostrup) Ingold	+	+	+	+
45. **Tetracladium setigerum** (Grove) Ingold	+	+	+	+
46. **Tricellula aquatica** Webster	+	+	+	+
47. **Tricellula botryosa** Descals	o	+	+	o
48. **Tricladium angulatum** Ingold	+	+	+	+
49. **Tricladium ? caudatum** Kuzuha (3A)	o	+	+	+
5o. **Tricladium curvisporum** Descals	+	+	+	+

Table 2 continued

	Hardwater		Softwater	
	Ybbs	Wulka	Ysper	Weitenbach
51. **Tricladium ? gracile** Ingold	+	o	+	o
52. **Tricladium splendens** Ingold	+	+	+	+
53. **Tripospermum camelopardus** Ingold	+	o	+	+
54. **Tripospermum myrti** (Lind.)Hughes	+	+	+	o
55. **"Triscelophorus sp."** (Ingold 1975) (2F)	+	+	+	+
56. **Varicosporium elodeae** Kegel	+	+	+	+
57. **Volucrispora graminea** Ingold, McDougall & Dann	+	+	+	+
58. **Volucrispora ornithomorpha** (Trotter) Haskins	+	+	+	+
59. unknown (2A)	o	o	+	o
60. unknown (2B)	+	+	+	+
61. unknown (2C)	+	+	+	+
62. unknown (3B)	o	+	+	o
63. unknown (3C)	o	o	+	+
64. unknown (4A)	o	o	+	+
65. unknown (4B)	+	+	+	+
66. unknown (4C)	+	+	+	+
67. unknown (5A B C D)	o	o	+	+
68. unknown (6B)	+	o	+	o
69. unknown (6C)	o	o	+	o
70. unknown (6D)	+	+	+	o
71. unknown (7B C)	+	+	+	+
72. sigmoid (8A)	+	+	+	+
73. sigmoid (8B)	+	o	+	+
74. sigmoid (8C)	+	o	+	+
75. sigmoid (7H)	o	+	+	o
76. sigmoid (7G)	o	+	o	o
77. sigmoid (8D)	+	+	+	+
78. sigmoid (9B)	o	+	+	+
79. sigmoid (9C)	o	+	+	o
80. sigmoid (8E)	+	+	+	+
identified species :	35	37	45	39
unidentified forms :	17	20	30	21
total :	52	57	75	60

Doubtful species are queried.

Discussion

Shearer & Webster (1985) found many species of aquatic hyphomycetes in the Teign, a slightly acid stream flowing through mixed deciduous woods in Devon, England. They question, whether the large number of species is due to an exceptionally high species diversity in the Teign or to additive effects of the different sampling methods used simultaneously.

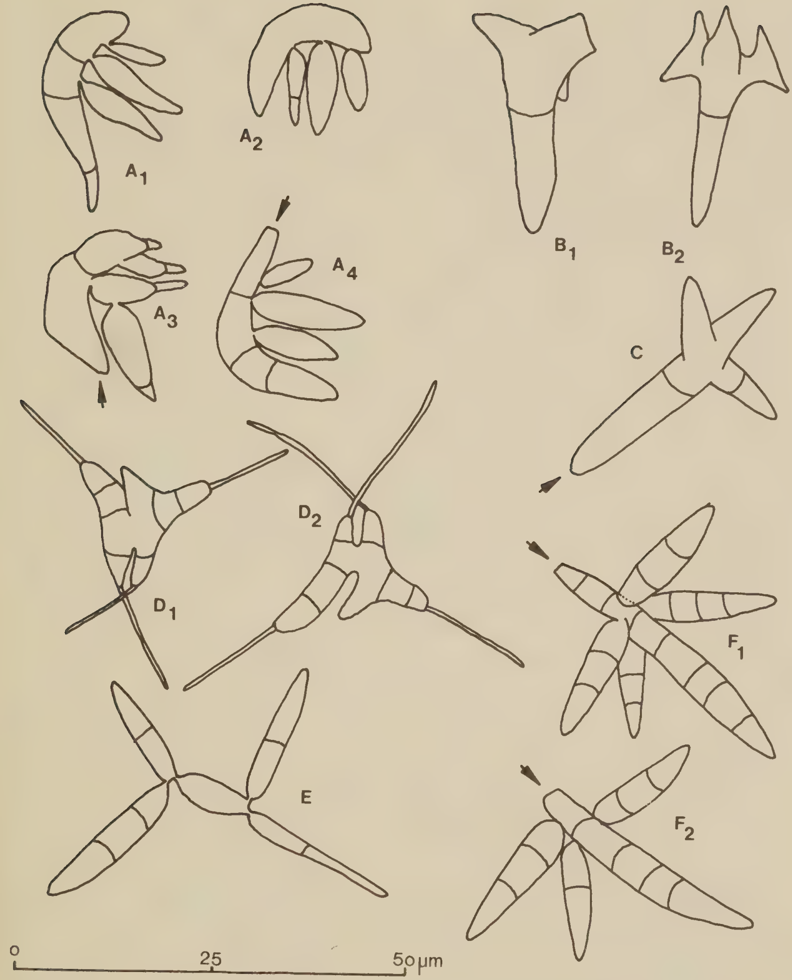


Figure 2: A unknown (59): Conidia of a species that seems to be close to **Gyoerffyella.** Ventral branching, an unusual feature, is characteristic of this genus.
B unknown (60): Frequent, but of an unnamed species resembling **Heliscus.** It has also been found in Spain.
C unknown (61). D **Campylospora ? chaetocladia** (10).
E **Articulospora angulata** (7). F unknown (56): This form seems to be the same as that referred to as **"Triscelophorus sp."** by Ingold (1975). This species is frequent and widely distributed, but conidia do not germinate under normal conditions. (Arrows indicate secession scars)

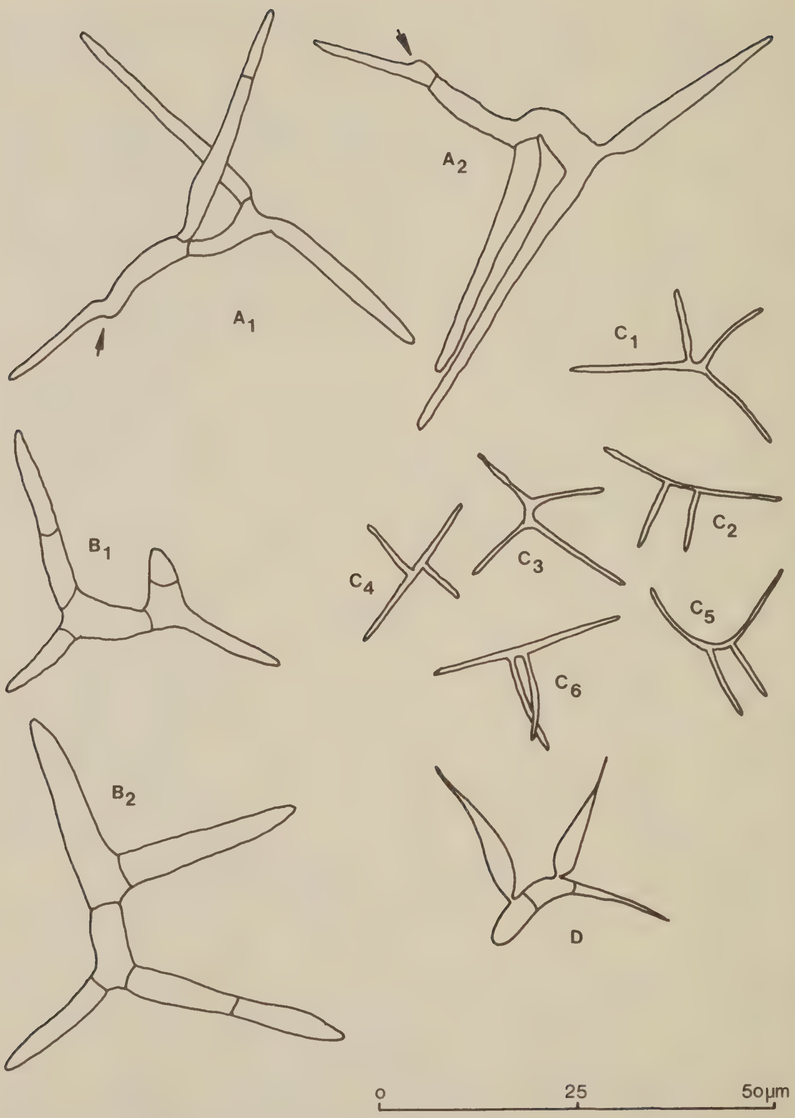

A1
A2
B1
B2
C1
C2
C3
C4
C5
C6
D
0
25
50µm

Figure 3: A **Tricladium ? caudatum** (49).
B unknown (62): The form might belong to **Tricladium**.
C unknown (63): The species is close to **Taeniospora**, a basidiomyceteous anamorph. D **Gyoerffyella ? oxalidis** (25).
(Arrows indicate secession scars)

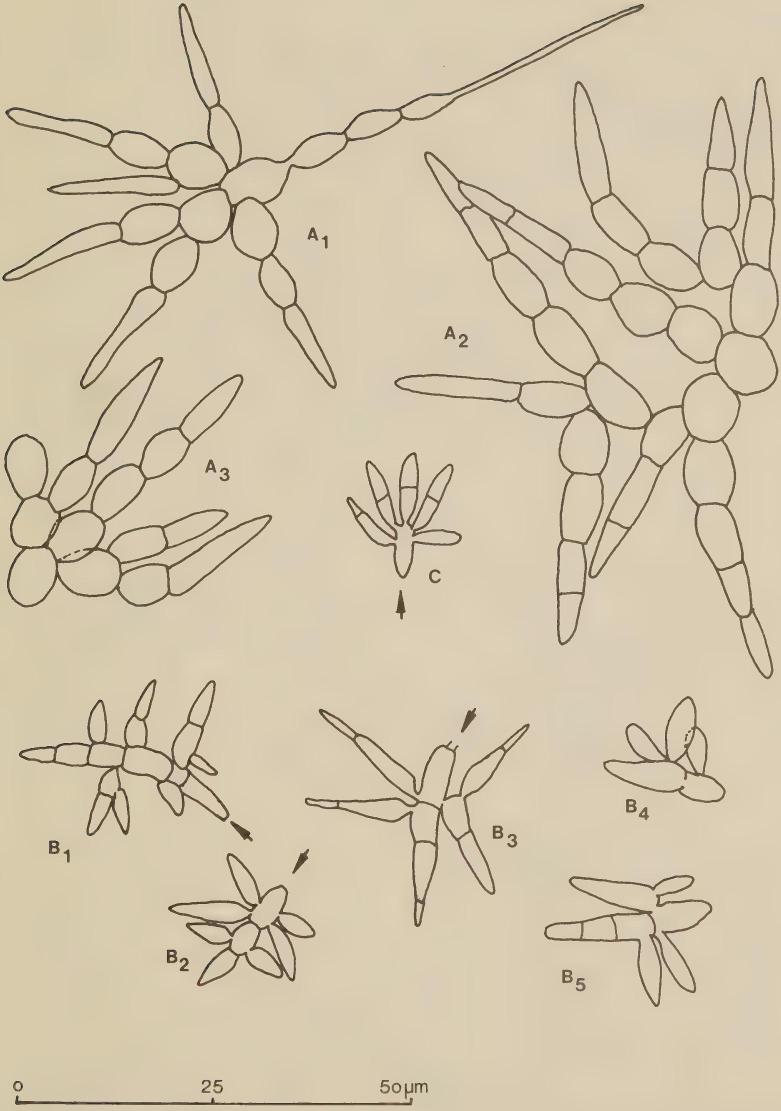


Figure 4: A unknown (64): A_1 germinating, the spora could be **Dendrospora moniliformis** or **Speiropsis irregularis**, both of which are presently being recombined in a new genus.
B unknown (65): Unidentified proliferous conidia.
C unknown (66): Species probably belongs to **Tricellula**.
(Arrows indicate secession scars)

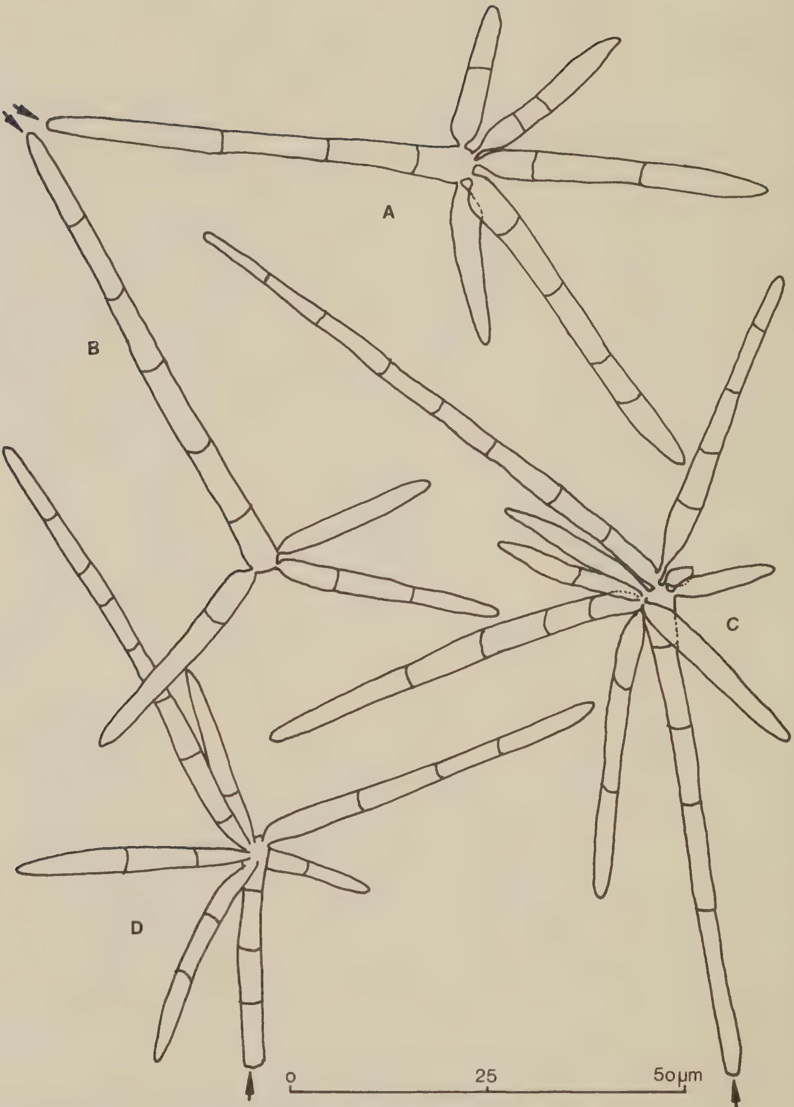


Figure 5: A,B,C,D unknown (67): The conidia with a main axis of variable lengh and apical branching resemble **Ordus**, a genus recently described from Japan (Ando & Tubaki 1983). (Arrows indicate secession scars)

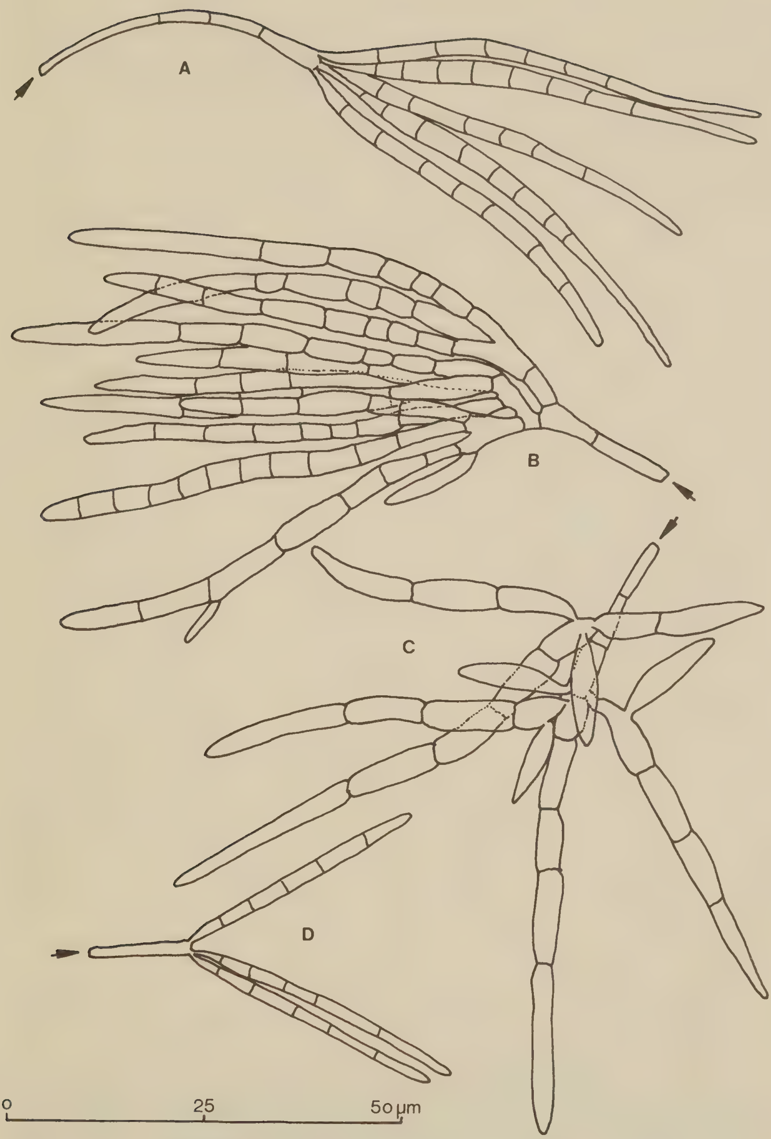

A
B
C
D
0
25
50 μm

Figure 6: A **Isthmotricladia sp.** (31). B unknown (68).
C **Dendrospora sp.?** (69). D unknown (7o).
(Arrows indicate secession scars)

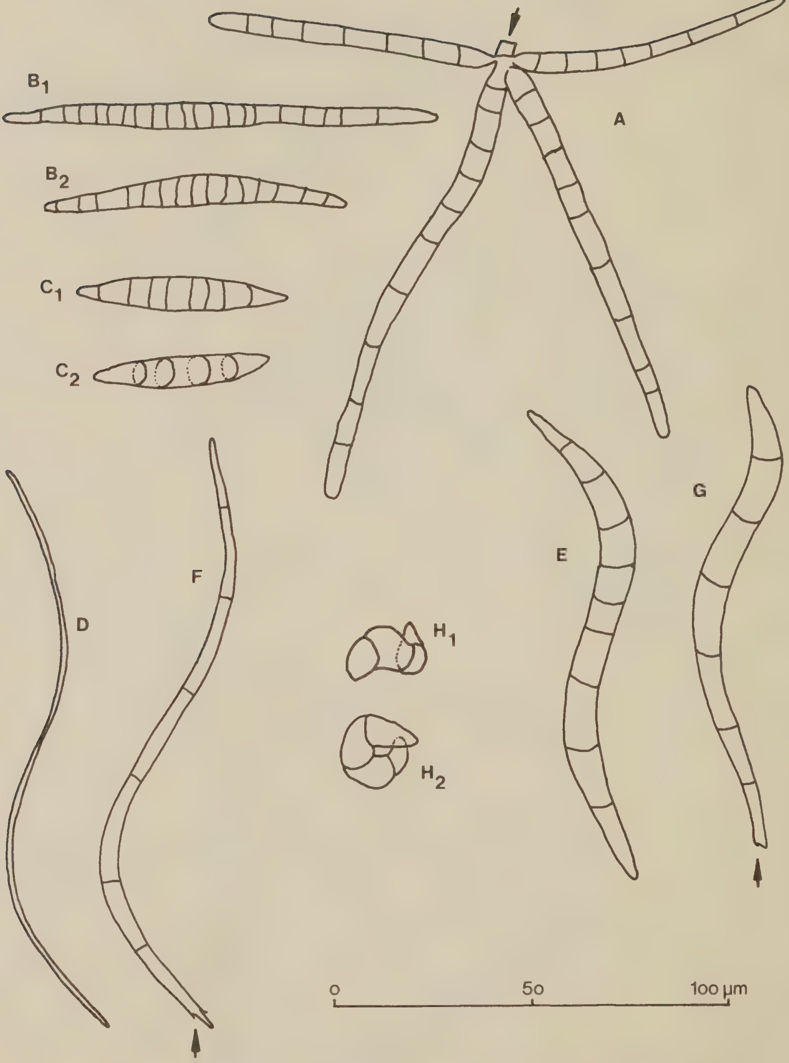


Figure 7: A **Dendrospora ? fastuosa** (17). B,C unknown (71). D **Flagellospora ? curvula** (23). E **Anguillospora crassa** (4). F **Anguillospora longissima** (6). G sigmoid (76). H sigmoid (75): The form has also been found in Spain but is still undescribed (Descals, unpublished). (Arrows indicate secession scars)

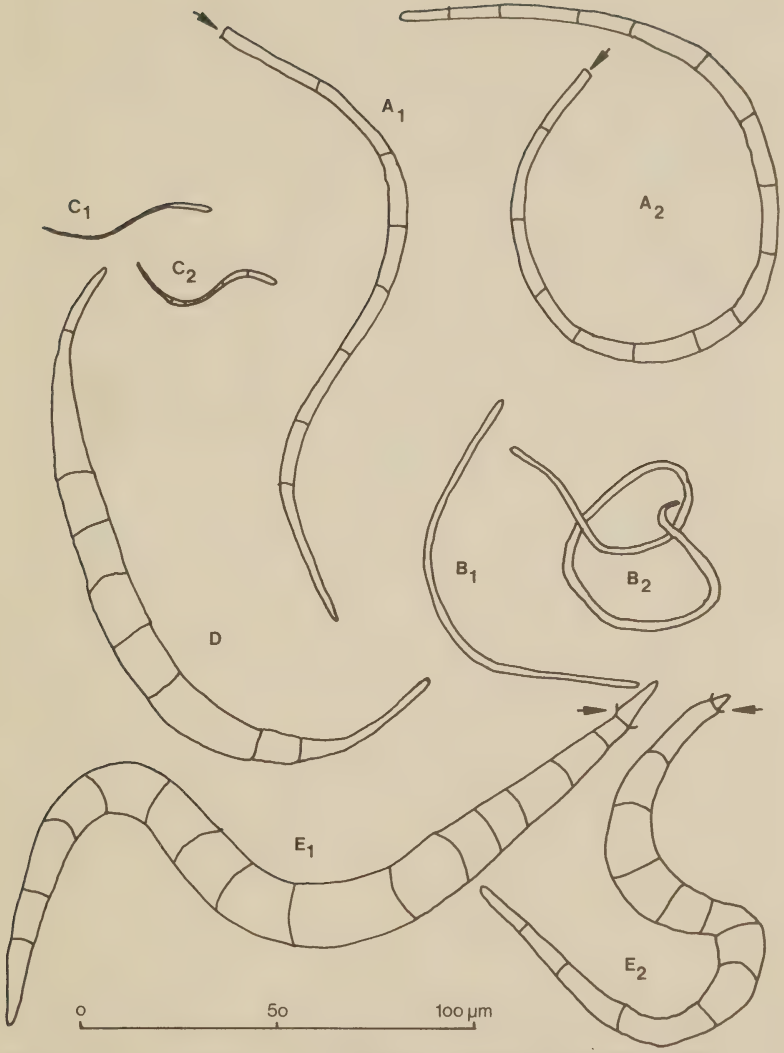


Figure 8: A sigmoid (72): Probably **Anguillospora rosea**, where the based scar tends to remain truncate.
B sigmoid (73). C sigmoid (74). D sigmoid (77): Most likely the anamorph of a **Massarina** from Switzerland, presently described by Webster (unpublished).
E sigmoid (80): resembles **Anguillospora crassa**. However, there are present distinct frills at the base of a percurrent scar, probably the remains of a separating cell. (Arrows indicate secession scars)

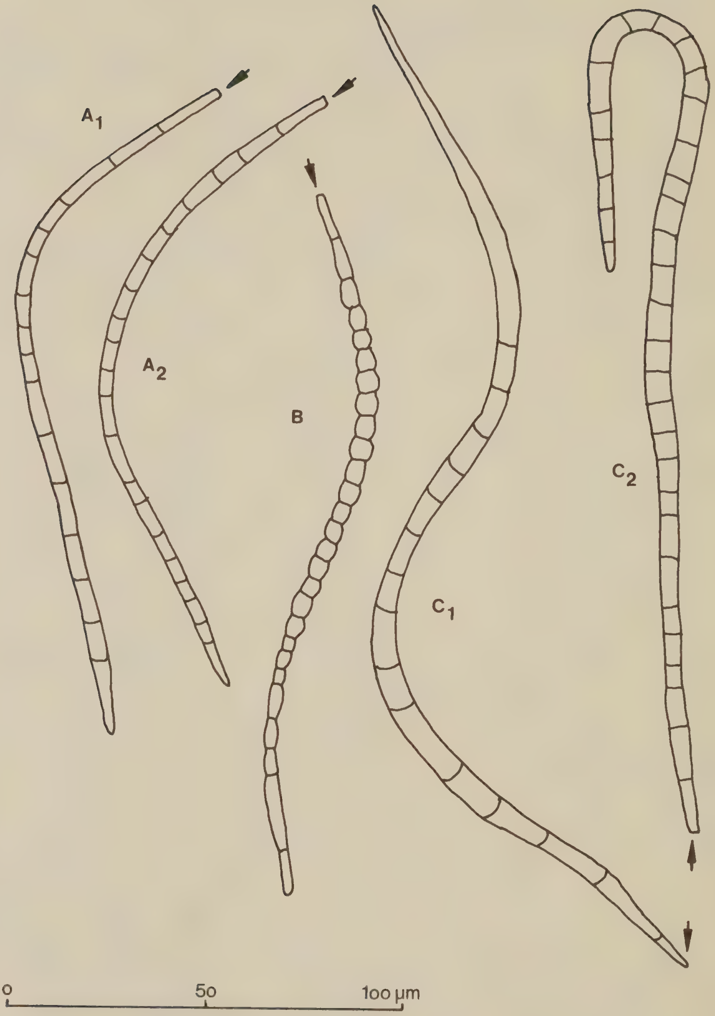


Figure 9: A,B,C sigmoids (5),(78),(79): Probably all forms belong to **Anguillospora furtiva**, with long, many-septate spores with a tendency to swell with age (B) and with rather irregular contours.
(Arrows indicate secession scars)

The sampling techniques used singly yield results that are biased in different directions: Foam contains the more bulky spores that are easily trapped, whereas examination of water samples favours the less easily trapped forms "that are left" in the water (Shearer & Webster 1985). Therefore, both methods should be used. To complete the picture of the stream spora, underwater substrates should also be examined. As leaves or wood are not available in all river reaches, baiting with such substrates could be used.

As the species composition in the stream changes with the season (Shearer & Webster 1985, Triska 197o), samples should be taken throughout a longer period of time. For a sound estimate of the stream spora, all mentioned sampling techniques should be used.

This report describes four Austrian rivers with distinctly different characteristics that were thus investigated. The number of species encountered in anyone of them is comparable to that from the Teign which therefore is no exception.

Probably a combination of unusual species diversity and favourable sampling conditions lead to the detection of so many species as in the upper Ysper in the course of this investigation: in one foamslide of September 1985 more than 5o species were found (Messner & Stüwe 1986).

The large number of undescribed aquatic hyphomycetes in Austrian waters definitely justifies further study.

This work was supported by the FWF (Fonds zur Förderung der wissenschaftlichen Forschung) in Austria.
E. Descals greatfully acknowledges financial assistance by the Generalitat de Catalunya (Spain) and thanks the Departament de Botanica, Universitat de Barcelona, for allowing him the use of their facilities.
The authors are grateful to Dr.L.Marvanová for reviewing the manuscript.

References

Ando K. & Tubaki K. (1983) **Ordus**, a new genus of hyphomycetes. Transactions of the mycological Society of Japan 24, 271-276.

Bärlocher F. & Rosset J. (1981) Aquatic hyphomycete spora of two Black Forest and two Swiss Jura streams. Transactions of the British Mycological Society 76, 479-483.

BMLF (1978) Bundesministerium für Land- und Forstwirtschaft: Gewässergütekarte Niederösterreich, Wasserwirtschaftskataster.

BMLF (1979) Bundesministerium für Land- und Forstwirtschaft: Gewässergütekarte Burgenland, Wasserwirtschaftskataster.

Eggenschwiler S. & Bärlocher F. (1983) Aquatic hyphomycetes in sixteen streams in France, Germany and Switzerland. Transactions of the British Mycological Society 81, 371-379.

Ingold C.T. (1949) Aquatic hyphomycetes from Switzerland.Transactions of the British Mycological Society 32, 341-345.

Ingold C.T. (1975) An illustrated guide to aquatic and water-borne hyphomycetes (Fungi Imperfecti). Freshwater Biological Association Scientific Publication No. 3o, 1-96.

Marvanová L. & Descals E. (1985) New and critical taxa of aquatic hyphomycetes. Botanical Journal of the Linnean Society 91, 1-23.

Messner K. & Oberzill W. (1974) Aquatische Pilze in Fließgewässern. Sonderdruck aus: Zentralblatt für Bakteriologie 24o, I. Referate, 4o3-4o6.

Messner K. & Stüwe B. (1986) Aquatische Hyphomyceten - außergewöhnlicher Formenreichtum in der Ysperklamm. Wasser und Abwasser 3o, 215-223.

Shearer C.A. & Webster J. (1985) Aquatic hyphomycete communities in the river Teign. I. Longitudinal distribution patterns. Transactions of the British Mycological Society 84, 489-5o1.

Triska F. (197o) Seasonal distribution of aquatic hyphomycetes in relation to the disappearance of leaf litter in a woodland stream. Ph.D. Thesis, University of Pittsburgh, 189pp.

Webster J. & Descals E. (1979) The teleomorphs of water-borne hyphomycetes from fresh water. In: The Whole Fungus, Vol.2, (ed.B.Kendrick), Ottawa: Nat.Museums of Canada, 419-451.

Webster J. & Descals E. (1981) Morphology, distribution and ecology of conidial fungi in freshwater habitats. In: Biology of Conidial Fungi, G.C.Cole and B.Kendrick (Eds.) London, Academic Press, Volume 1, pp. 295-355.

Weninger (in press): Limnologie der Ybbs, der Ysper und des Weitenbachs. In: Limnologie der österreichischen Donau-Nebengewässer II. Bundesministerium für Land- und Forstwirtschaft, Wasserwirtschaftskataster.

MYCOTAXON

Vol. XXX, pp. 455-458 October-December 1987

A NEW SPECIES OF COMATRICHA FROM COLORADO

M. L. FARR

United States Department of Agriculture
Agricultural Research Service
Beltsville Area
Biosystematics and Beneficial Insects Institute
Systematic Botany, Mycology and Nematology Laboratory

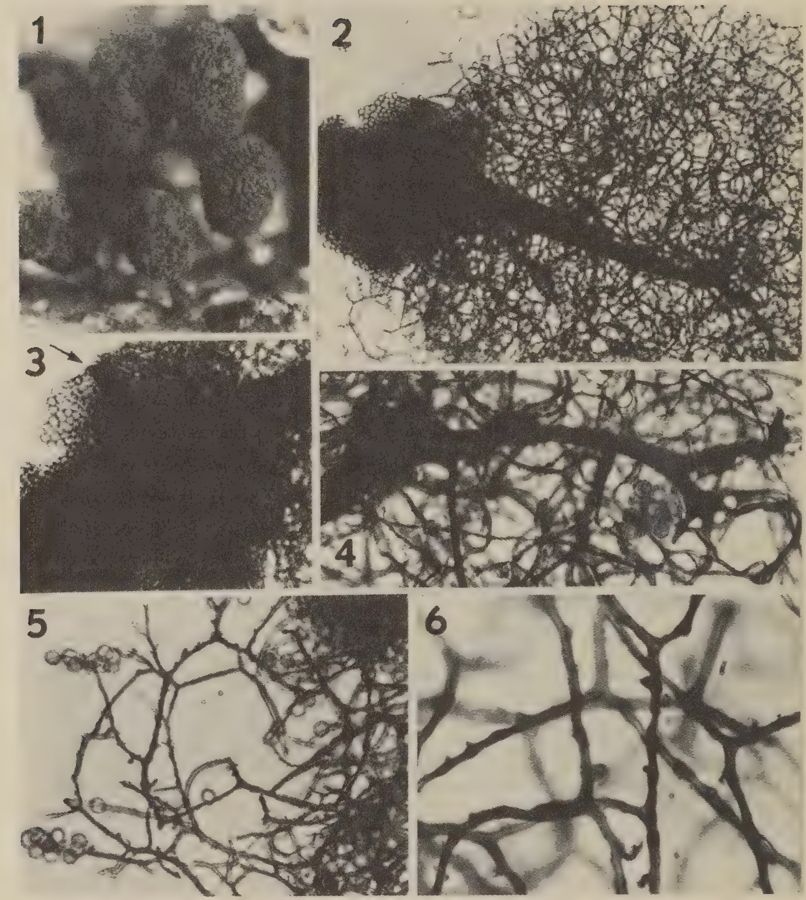
Although true slime molds of the mountainous regions of the western United States have been collected and studied rather extensively since the beginning of this century, the last two decades have produced discoveries of a number of previously undescribed species from that region (Kowalski, 1968, 1972). The present paper adds another new species from that habitat.

Comatricha subalpina Farr & Stephenson sp. nov. (Figs. 1-10).

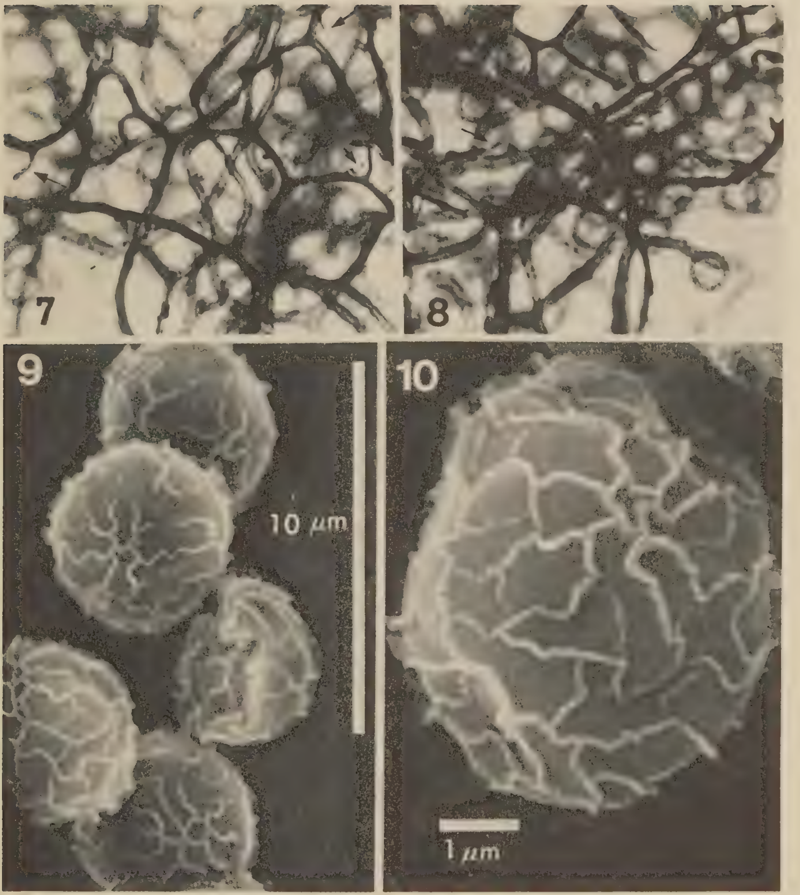
Sporangia in fasciculis gregariis laxe aggregata, saturate purpureobrunnea, stipitata, subglobosa ad obovoidea, ellipsoidea, vel late cylindracea, 1-1.5(-2) mm alta, circa 0.5-0.7 mm crassa, vel 0.6-0.7 mm diam. Hypothallus ± continuus, membranaceus, brunneolus vel lucidus. Stipes robustus, anthracinus, 1/3-1/2 altitudinis totae. Columella apice saepe 2-3-furcata. Peridium evanescens, interdum in forma annuli circum apicem stipitis remanens. Capillitium dense reticulatum, ex filis implexis atrobrunneis flexuosis marginibus irregularibus constans, verrucis baculis nodulis et ramulis tenuibus a 6 um longis, ad peripheriam extremis liberis numerosis interdum pallidis praeditum. Sporae globosae, luce reflexa saturate purpureobrunneae, luce transmissa pallide vel vix lilaceobrunneae, 6-7 um diam, reticulo sinuoso sculptae. Plasmodium ignotum.

Holotype. Colorado: Gunnison Co., Schofield Pass, elev. ca 3260 m, 18 Aug., 1983, on rotten decorticated wood in subalpine Picea engelmannii Engelm./Abies lasiocarpa (Hook.)Endl. forest, S. L. Stephenson 2049 (BPI). The type specimen consists of about two dozen sporangia plus two mounted on slides. Known only from the type.

Sporangia in small loose clusters, deep purplish brown, stipitate, subglobose to obovoid, ellipsoid, or broadly subcylindrical, 1-1.5(-2) mm tall, ca 0.5-0.7 mm thick, or 0.6-0.7 mm diam if subglobose. *Hypothallus* ± continuous, membranous, brownish or lustrous. *Stalk* robust, black, ± lustrous, sometimes flared at base, one-third to one-half the total height, attenuated inside sporangium as a *columella* which attains the apex and there often divides into 2-3 major branches. *Peridium* occasionally in part persistent at base as a collar or a few small flakes.



FIGS. 1-6. *Comatricha subalpina* (from holotype). 1. Habit, X 15. 2. Portion of mounted, subglobose sporangium, X 100. 3. Base of same sporangium, showing collar (arrow), X 150. 4. Tip of columella, as one example of apical branching, X 350. 5. Peripheral portion of capillitium, showing short, pallid free ends, X 350. 6. Capillitial ornamentation, X 800.



FIGS. 7-10. *Comatricha subalpina* (from holotype). 7-8. Capillitium with delicate branchlets (arrows), and spores, X 800. 9-10. Spore ornamentation (SEM).

Capillitium arising all along columella and its apical branches, densely reticulate, consisting of tangled, flexuous, dark brown filaments with uneven margins, beset with numerous verrucae, short rods ("bacula" of SEM terminology, see Rammeloo, 1975), nodules, and delicate branchlets up to 6 um long, and with abundant, sometimes pale free ends at the periphery. *Spores* globose, purplish brown in mass, nearly colorless to pale grayish or lilaceous brown by transmitted light, 6-7 um diam, marked with nearly complete, wavy, banded reticulations. *Plasmodium* unknown.

Comatricha subalpina is one of the few species of *Comatricha* Preuss with reticulate spores. Among these it is morphologically closest to *C. anomala* Rammeloo, *C. reticulospora* Ing & Holland, and *C. reticulata* H. C. Gilbert. In *C. anomala* the apex of the columella is tapered and the spores are larger and baculate with only small patches of reticulum (excellently shown in the SEM of Kowalski and Demaree, 1987). *Comatricha reticulata* likewise has a gradually dissipating columella, as well as slightly larger spores (7-9 um), whereas in *C. reticulospora* the spores are verrucose-reticulate. Furthermore, all three of these species have more narrowly cylindrical sporangia and a smooth capillitium.

ACKNOWLEDGMENTS

I thank M. E. Palm and M. Blackwell for reviewing the manuscript. J. Plaskowitz assisted with the photography.

LITERATURE CITED

Kowalski, D. T. 1968. Three new species of *Diderma*. Mycologia 60: 595-603.

____. 1972. Two new alpine myxomycetes from Washington. Mycologia 64: 359-364.

____. and R. S. Demaree. 1987. *Comatricha anomala*, a new record for the Western Hemisphere. Mycologia 79: 140-141.

Rammeloo, J. 1975. Structure of the epispore in the Stemonitales (Myxomycetes) as seen with the scanning electron microscope. Bull. Jard. Bot. Nat. Belg. 45: 301-306.

MYCOTAXON

Vol. XXX, pp. 459-463 October-December 1987

A NEW SPECIES OF THE GENUS SUBULISPORA

A. NAWAWI and A.J. KUTHUBUTHEEN

Department of Botany, University of Malaya,
59100 Kuala Lumpur, Malaysia.

Subulispora longirostrata sp.nov., collected from decaying leaves under water from Malaysia is described and illustrated.

The genus **Subulispora** was erected by Tubaki apud Tubaki & Yokoyama(1971) to accommodate two species of hyphomycetes with subulate, hyaline conidia with a broad truncate base, and the apical cell drawn into a fine hair-like appendage. Conidia are borne on sympodially proliferating conidiogenous cells with flat, thin-walled scars. The type species **S.procurvata** Tubaki has a curved appendage while the appendage in the second species, **S.rectilineata** Tubaki is straight. The genus has recently been reviewed by Hoog(1985) who recognised eight species. With more species added the concept of the genus has broadened somewhat to include not only hyphomycetes with subulate conidia bearing apical appendages as originally intended, but it now also includes species with filiform to cylindrical conidia devoid of appendages.

S.procurvata appears to be widespread on leaf litter especially from subtropical and tropical regions. Outside Japan it has been reported from the Solomon Islands (Matsushima, 1971), Tanzania (Pirozynski,1972), Taiwan (Matsushima,1980), Kenya (Kirk,1985) and India (Rao & Hoog, 1986). In Malaysia conidia of this fungus are common in foam samples and on leaf litter from several localities (Nawawi, 1985). In terms of conidial morphology and size the Malaysian isolates (IMI 316800) are comparable to those reported elsewhere. In addition, a species of **Subulispora** rather similar at first glance to **S.procurvata** is frequently encountered on decaying leaves, especially those submerged in freshwater streams. Compared to **S.procurvata** it has shorter and broader conidia but with a longer and more sharply bent apical appendage. These differences merit separation at the species level.

Subulispora longirostrata sp.nov. (Figs 1 – 2)

Coloniae effusae, brunnea, inconspicuae. Mycelium partim superficiale, partim in substrato immersum, ex hyphis laevibus, ramosis, septatis, brunneis 1.5 – 2.5 µm latis compositum. Conidiophora macronematosa, mononematosa, solitaria, simplicia, recta vel leviter flexuosa, laevia, 2 – 8 septata, brunnea, ad apicem geniculata et pallidiora, 20

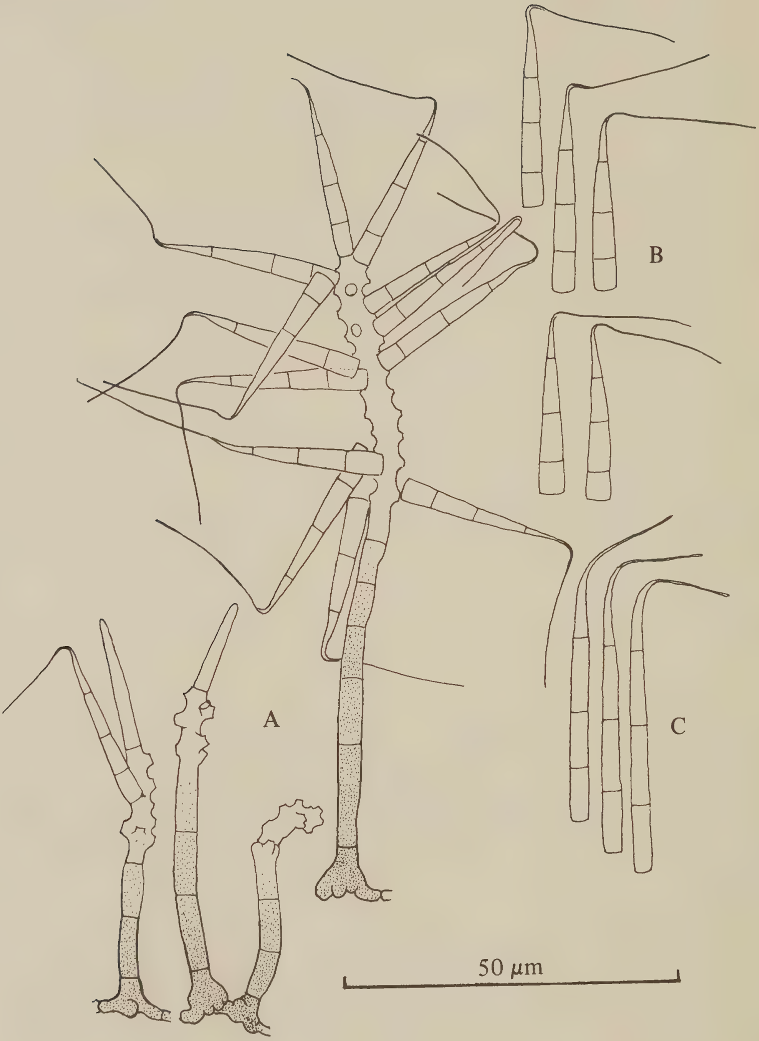


Fig.1. **Subulispora longirostrata.** (A) Conidiophores bearing developing and mature conidia; (B) Typical conidia; (C) Conidia of **S.procurvata** for comparison.

– 147 µm alta x 3 – 4 µm lata, ad fundamentum leviter inflata, 10 – 15 µm lata. Cellulae conidiogenae in conidiophoris incorporatae, terminales, sympodiales. Conidia acrogena, solitaria, deim acropleurogena, conico-subulata, 3-euseptata, apice flexe appendiculate attenuata, 15 – 25 µm longa, laevia, hyalina, pallide brunnea-flava in massa, ad basim abrupte truncata, cicatrice applanata et leviter incrassata, 3 – 4 µm lata, 25 – 34 µm longa (appendicula exclusa). Conidiorum secessio schizolytica.

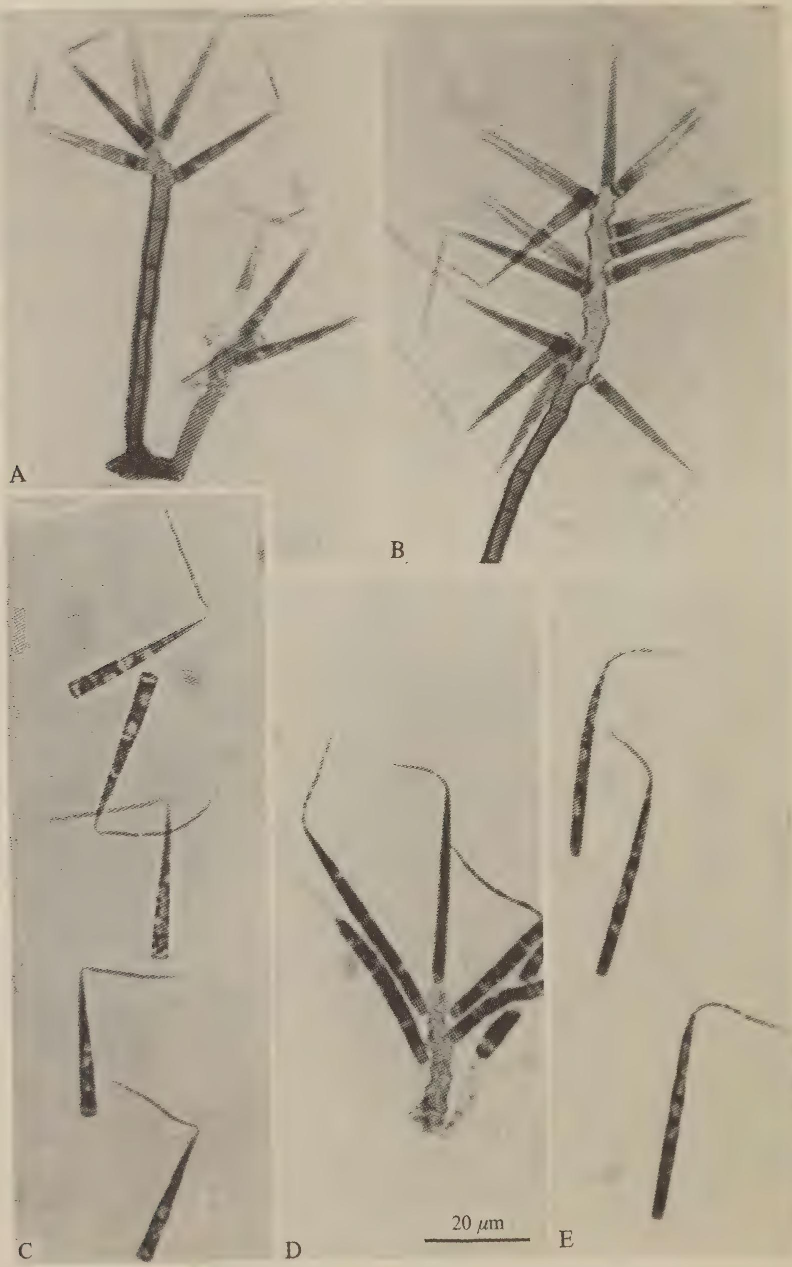
Ex foliis angiospermis putrescentibus in flumine immersi, Mimaland, Selangor 20 Apr. 1987, A. Nawawi, IMI 316801 holotypus.

Colonies effuse, brown, inconspicuous. Mycelium partly superficial, partly immersed in the substratum, composed of smooth, branched septate brown hyphae 1.5 – 2.5 µm wide. Conidiophores macronematous, mononematous, solitary or in groups of two, erect, simple, straight to slightly flexuous, geniculate towards the apex, smooth, 2 – 8 euseptate, brown, darker towards the lobed base, paler towards the apex, 20 – 147 µm high, 3 – 4 µm wide, 10 – 15 µm at the swollen base. Conidiogenous cells integrated in the conidiophores, terminal, sympodial, 10 – 22 µm long x 3.5 – 4.5 µm wide. Conidia acrogenous, solitary, later acropleurogenous, smooth, hyaline, pale buff in mass, 3-euseptate with a broad flat, slightly thickened scar, 3 – 4 µm wide at the base, and with a thin flexed hyaline appendage at the apex disposed at 75 – 110° to the axis of the conidium, 25 – 34 µm long (excluding the appendage), tapering gradually upwards to form the thin, hair-like, abruptly bent, non-septate, hyaline appendage, which is 15 – 25 µm long x 0.5 µm wide with an arcuate notch at the point of inflexion. Conidial secession schizolytic.

Other specimens examined: On submerged decaying leaves incubated in moist chambers, Lepar Forest Reserve, Pahang, July 1986, A.J. Kuthubutheen; Pasuh Forest Reserve, Negri Sembilan, Nov. 1986, A. Nawawi; Botanical Gardens, Penang, July 1987, A. Nawawi; Gombak Field Studies Centre, Selangor, July 1987, A. Nawawi.

Conidia germinate readily on agar media by producing germ-tubes from the base and cells of the main body. On CMA the colonies are dark brown with scanty aerial mycelium, finely zonate with broad radial striations, reverse concolorous. The fungus is of moderate growth reaching a diam of 44 mm in 21 d at 25 – 28°C. Sporulation was abundant starting from the centre and progressing towards the margin, imparting a greyish fawn, powdery appearance to the colony. Conidiophores formed on agar tend to be long and flexuous and the geniculate conidiogenous zone proliferates profusely reaching up to 180 µm long and bearing up to 62 scars or more. Conidia formed on agar are similar in shape and size to those formed on the leaf pieces.

While conidial ontogeny, maturation, secession and regeneration of the conidiogenous cells appear to be the


A
B
C
D
20 μm
E

same as in **S.procurvata, S.longirostrata** differs in the shape and size of the conidia. In **S.procurvata** the main body of the conidium is longer and slightly narrower, measuring 32 – 45 µm long x 2.5 – 3 µm wide, subulate, attenuating gradually towards the apex with the terminal cell drawn into a thin, smoothly bent appendage 9 – 17 µm long subtending an angle of 40 – 90° with the axis of the conidium. In **S.longirostrata** the conidia are subulate-conoid, with a shorter main body(25 – 34 µm), wider base(3 – 4 µm) and longer appendage(15 – 25 µm). The appendage is sharply bent with an arcuate notch at its point of inflexion and in the majority of cases forms an angle of 75 – 110° with the main body of the conidium. There is also a difference in colony characteristics. On CMA **S.procurvata** forms dark olivaceous brown colonies with felty aerial mycelium, reverse dark brown to black, attaining a diam of 55 mm in 21 d at 25 – 28°C. Sporulation is equally abundant.

We thank Professor J. Webster, University of Exeter for reviewing the manuscript and for helpful comments.

REFERENCES

Hoog, G.S.de (1985). Taxonomy of the **Dactylaria** complex, IV. **Dactylaria, Neta, Subulispora** and **Scolecobasidium.** Studies in Mycology 26; 1 – 60.

Kirk, P.M. (1985). New or interesting microfungi XIV. Dematiaceous hyphomycetes from Mt. Kenya. Mycotaxon 23, 305 – 352.

Matsushima, T. (1971). Microfungi from the Solomon Islands and Papua-New Guinea. Kobe, published by the author.

Matsushima, T. (1980). Saprophytic microfungi from Taiwan. Part I. Hyphomycetes. Matsushima Mycological Memoirs 1, 1 – 82.

Nawawi, A. (985). Aquatic hyphomycetes and other water-borne fungi from Malaysia. Malayan Nature Journal 39, 75 – 134.

Pirozynski, K.A. (1972). Microfungi of Tanzania.I. Miscellaneous fungi on oil palm.II. New hyphomycetes. Mycological Papers 129, 1 – 64.

Rao, R. & Hoog, G.S.de (1986). New or critical hyphomycetes from India. Studies in Mycology 28, 1 – 84.

Tubaki, K. & Yokoyama, T. (1971). Notes on the Japanese hyphomycetes V. Transactions of the Mycological Society of Japan 12, 8 – 28.

Fig.2. **Subulispora longirostrata.** (A – B) Conidiophores with attached conidia; (C) Conidia from leaves; **S.procurvata** (D) Part of conidiophore with conidia; (E) Conidia.

MYCOTAXON

Vol. XXX, pp. 465-471 October-December 1987

TWO NEW SPECIES OF THE GENUS WYNNEA FROM CHINA WITH A KEY TO KNOWN SPECIES

BO LIU JIN-ZHONG CAO
Department of Biology, Shanxi University, Taiyuan, China
and
MEI-HUA LIU
Anshun Prefecture Sanition and Antiepidemic Station
of Guizhou Province, Anshun, China

SUMMARY

Two new species, Wynnea macrospora and W. sinensis, are described and illustrated from Guizhou Province, China. A key to known species of Wynnea is provided.

The genus Wynnea Berk .et Curt. in Berk. was monographed by Pfister (1979), in which four species were accepted. A few years ago, one of us (Mei-hua Liu) collected some specimens belonging to Wynnea from Guizhou Province. In detail studies both on macro- and microscopic have been made and results convince us that they have never been described before, so two new species are proposed and named as Wynnea macrospora and W. sinensis.

1. Wynnea macrospora Liu et Cao sp. nov. Figs. 1, 3.

Apothecia erecta, spathulata vel auriculata, 4.5-6.5 cm alta, 2-3.5 cm lata, plerumque caespitosa, cartilaginea vel subgelatinosa. Hymenium fuscum in statu sicco, olivaceo-brunneum in statu humectato; excipulum badium, rugosum, glabrum. Stipes teres, solidus, badius, 1.5-2 cm altus, 0.5-1 cm latus. Sclerotium usque ad 4 x 2.5 cm, subgelatinosum, brunneolum, irregulater lobatum. Excipulum medullare 750-850 µm crassum, e textura laxe intricata compositum, hyphis 7.5-12.5 µm diam.; excipulum ectale 150-200 µm crassum, e textura subglobosa vel angulata.

Asci cylindrici, 320-350 µm longi, 19-22.5 µm lati, I-, 8-spori. Ascosporae fusoideae, (40-) 42-47.5 x 17-18 µm, uniseriatae, hyalinae, multiguttulatae, striis longitudinalibus, obscurus, ± apiculatae. Paraphyses septatae, 4-5 µm crassae, apice usque ad 7-8 µm, subhyalinae.

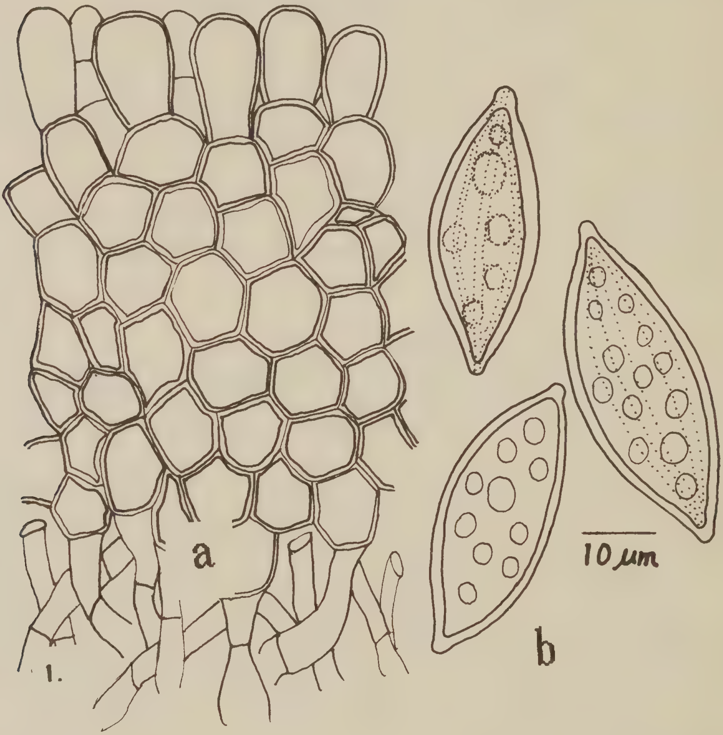


Fig. 1, Wynnea macrospora. a. ectal excipulum; b. spores.

Specimen typicum in Myco. Herb. Shan. Univ. (MHSU) conservatum est; on ground under bamboos, alt. 1500 m, Suiyang County, Guizhou Province, China, Aug. 2, 1984, Mei-hua Liu (MHSU 570, Typus).

Apothecia erect, spoon-shaped to otideoid, 4.5-6.5 x 2-3.5 cm, cartilaginous to subgelatinous, margin somewhat involute, usually several arising from a common stalk which in turn springs from a sclerotium. Hymenium dark brown when drying, olive brown when immersing in

water;outside surface chocolate brown, wrinkled when drying, without tomentum or verrucae. Stalk terete, solid, concolorous with outside surface, up to 1.5-2 x 0.5-1 cm. Sclerotium irregularly lobed, tough to subgealtinous, pale brown, internally chambered, up to 4 x 2.5 cm, hypogeaous.

Hymenium 320-350 µm; medullary excipulum 750-850 µm, of textura intricata of hyaline, thin-walled, septate, branched hyphae reaching 7.5-12.5 µm; ectal excipulum 150-100 µm, of textura angularis to textura globulosa of slightly thick-walled, brown cells, up to 10-12 µm in diam., outermost cells slightly elongate.

Asci cylindrical, 8-spored, obtuse apically, thick-walled, I-, 19-22.5 µm wide, tapering below into a long , narrow base. Ascospores (40-) 42-47.5 x 17-18 µm, uniseriate, hyaline, most bilaterlly symmetrical, marked with very faint striation, more or less apiculate. Paraphyses septate, branched below, subhyaline, 4-5 µm wide, slightly swollen apically, up to 7-8 µm.

This new species differs from other species of the genus in its larger spores and faint striation, the color of hymenium and wrinkled outside surface. The shape of the spores seems to be intermediary between Wynnea americana Thaxter and W. sparassoides Pfister except without distinct striation. The spores of the new species are the largest among known species, the color of hymenium is very peculiar in this genus when immersing in water.

2. Wynnea sinensis Liu et Cao sp. nov. Figs. 2, 4.

Apothecia erecta, spathulata vel auriculata, 8-9 cm alta, 5-6 cm lata, plerumque caespitosa, cartilaginea vel subgelatinosa. Hymenium subflavum in statu sicco, subrufobrunneum in statu humextato; excipulum subflavum, planum, glabrum. Stipes pluri-furcatus, solidus, 3.5 cm altus , 2.5 cm latus. Sclerotia nulla. Excipulum medullare 1150 -1200 µm crassum, e textura laxe intricata compositum, hyphis 5-12.5 µm diam.; excipulum ectale 50-70 µm, e textura prismata constans.

Asci cylindrici, 300-320 µm longi, 13-14 µm lati, I-, 8-spori. Ascosporae ellipsoideae, 26-30 x 12.5-13 µm, uniseriatae, hyalinae, striis longitudinalibus, obscurus. Paraphyses septatae, 4-4.5 µm crassae, subhyalinae.

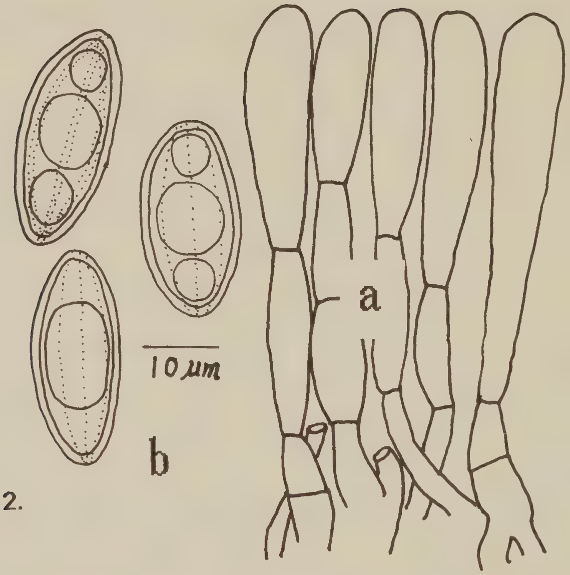


Fig. 2, Wynnea sinensis. a. ectal excipulum; b. spores.

Specimen typicum in Myco. Herb. Shan. Univ. (MHSU) conservatum est ; on wood under bamboos, alt. 1900 m, Panxian County, Guizhou Province, China, Sept. 12, 1984, Meihua Liu (MHSU 571, Typus) .

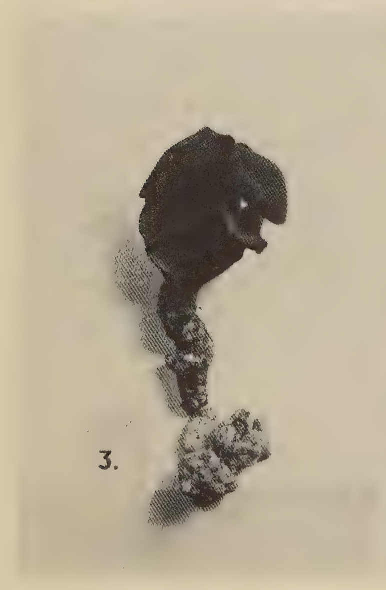
Apothecia erect, ear-shaped, 8-9 x 5-6 cm, tough, several arising from a common sclerotium-like (not trun sclerotium) base. Hymenium pale yellow on drying, light reddish brown when immersing in water; outside surface pale yellow, even, smooth. Stalk many-forked, solid, 3.5 x 2.5 cm.

Hymenium 300-320 µm; medullary excipulum 1150-1200 µm, of textura intricata of hyaline, septate, branched, thin-walled hyphae reaching 5-12.5 µm; ectal excipulum 50-70 µm, of thin- to slightly thick-walled, light brown cells, outermost cells clavate, up to 10-20 µm wide, palisade of 1-3 layered cells.

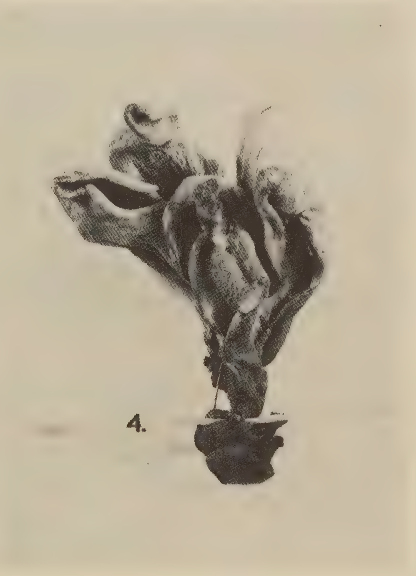
Asci cylindrical, 8-spored, obtuse apiclly, thick-walled, I-, 13-14 µm wide, tapering below into a long and narrow base. Ascospores 26-30 x 12.5-13 µm, uniseriate, hyaline, most of bilaterally symmetrical, marked with faint stration, ellipsoid, 1-3 guttulate. Paraphses septate, branched below, subhyaline, 4-4.5 µm wide, slightly swollen apically.

This new species somewhat resembles *Wynnea gigantea*, but differs from the latter in size and shape of ascospores, and the color of apothecia. It is also close to *W. macrotis*, but differs in its smooth appearance of outside surface, the construction of ectal excipulum, as well as in the color and size of apothecia.

The habit of *Wynnea sinensis* is very rare in this genus. Most species of *Wynnea* are occuring in soil. "The single report of *Wynnea* on wood is in Berkeley's original description of *W. macrotis*" according to Pfister (1979), in which he holds that the species of *Wynnea* would be found in recently fallen plant parts. Whether the habit would be diagnostic or not, is still in question at present.



3.



4.

Fig. 3, *Wynnea macrospora*. apothecia of holotypus.
Fig. 4, *Wynnea sinensis*. apothecia of holotypus.

By now, six species of the genus *Wynnea* are recognized. The delimination of the genus and other four species follow Pfister's concept (1979). There might be still some undescribed species. For convenience, we provided a key to six known species here.

Key to the species of *Wynnea*

1. Apothecia sparassoid, fertile parts more or less globose, ectal excipulum intermixed with hyphoid elements........................*W. sparassoides* Pfister
1. Apothecia spoon-to ear-shaped, ectal excipulum not intermixed with hyphoid elements...................2
2. Outside surface with verrucae or tomentum.......3
2. Outside surface either smooth or wrinkled, without verrucae or tomentum...............................4
3. Outside surface verruculose, spores 35-38 x 12-14 (-18) µm with prominent striations and ± apiculate ....*W. americana* Thaxter
3. Outside surface tomentose, spores 29-31 (-32) x 12-13 µm with faint striations and ± flattened ends ....*W. macrotis* (Berk.) Berk.
4. Spores larger than 40 µm, outsid surface wrinkled ....*W. macrospora* Liu et Cao
4. Spores less than 35 µm 5
5. Apothecia pale yellow brown on both surfaces, spores ± ellipsoid, 26-30 x 12.5-13 µm ....*W. sinensis* Liu et Cao
5. Apothecia dull rust-colored on both surfaces when drying, spores ± naviculate, 30-33 (-35) x 13-16 µm.... ....*W. gigantea* Berk. et Curt.

ACKNOWLEDGMENTS

We are deeply grateful to Dr. D. H. Pfister and Dr. R. P. Korf for reviewing this manuscript.

REFERENCES

Korf, R. P. 1972. Synoptic key to the genera of the Pezizales. Mycologia 64: 937-994.

Nagasawa, E. 1984. Sclerotia of Wynnea gigantea. Rrpt. Tottori Mycol. Inst. (Japan) 22: 80-81.

Pfister, D.H. 1979. A monograph of the genus Wynnea (Pezizales, Sarcoscyphaceae). Mycologia 71: 144-159.

Rifai, M.E. 1968. The Australasian Pezizales in the herbarium of the Royal Botanic Gardens, Kew. Verh. Kon. Ned. Akad. Wetensch., Afd. Naturk., II 57: 1-295.

Teng, S.C. 1963. Fungi of China. (in Chinese) 286. Science Press, Beijing.

Waraitch, K.S. 1976. New species of Aleuria and Wynnea from India. Trans. Brit. Mycol Soc. 67: 533-536.

MYCOTAXON

Vol. XXX, pp. 473-499 October-December 1987

A TAXONOMIC REVISION OF THE GENUS MARCELLEINA

JIŘÍ MORAVEC

Sadová 21/5, č. 336, 679 04 Adamov u Brna,
Czechoslovakia

ABSTRACT

Ascospore ornamentation of collections of Marcelleina Brumm.,Korf et Rifai was studied and compared with that in the type specimens of Detonia rickii Rehm, Lamprospora jetelae Vacek, Barlaea subcoerulea Kirchst. and Marcelleina brevicostatispora J.Mor. A neotype for Lamprospora georgii Svrček has been designated and two new combinations proposed. As a result, seven species, Marcelleina persoonii (H.et P. Crouan) Brumm., M. rickii (Rehm) Graddon, M. georgii (Svr.) J.Moravec comb.nov., M. brevicostatispora J.Mor., M. pseudoanthracina (Donad.) Kristiansen et J.Moravec comb. nov., M. benkertii J.Moravec spec. nov. and M. donadinii Astier et J.Moravec spec. nov. are recognised. Lamprospora jetelae (= Pulparia jetelae (Vacek) Svr. is a synonym of M. rickii and Barlaea subcoerulea is identical with M. persoonii. Examination of the type of Pulparia arctica Karst. has confirmed that the generic name Pulparia Karst. emend Korf et al. has been misapplied. The type specimens of Greletia planchonis (Dun.ex Boud.) Donad. and other species of Greletia have also been examined, and notes on several species are added. The taxonomy of the genus Marcelleina and its distinction from the related genera Greletia Donad. and Smardaea Svr. are discussed. A new subfamily, Aleurinoideae of the family Pyronemataceae is proposed. Ascospore ornamentation is illustrated by line drawings and SEM photomicrographs.

INTRODUCTION

The genus Marcelleina, erected by Brummelen, Korf et Rifai in Brummelen (1967) to replace Barlaeina Sacc. sensu Le Gal (1953), was insufficiently circumscribed. The name Marcelleina is the correct name for the genus represented by the type species M. persoonii (H.et P.Crouan) Brumm. The generic name Pulparia Karsten emend Korf et al. in Korf (1972) used recently by by many authors for fungi here placed in Marcelleina, is based on Pulparia arctica Karsten (1866), a fungus which is quite different from M. persoonii. The use of Pulparia in this sense was not accepted by Dennis (1978) and was questioned by Benkert et J.Moravec (1986). Recently Pfister (1985), after his correspondence with Professors Korf and Dissing,abandoned Pulparia as a generic name for discomycetes represented by M. persoonii. Reexamination of the type of Pulparia arctica Karst. has confirmed this opinion and I agree fully with Dissing (in litt.),who has previously examined the type,that this species is not congeneric with Marcelleina. Donadini (1979) erected the new genus

Greletia Donad. with type species *Greletia planchonis* (Dun. ex Boud.)Donad. as a segregate from *Pulparia* (= *Marcelleina*). The genus *Greletia* now comprising 6 species, is well founded and distinguished from *Marcelleina* especially by the presence of purplish pigment in the asci, ascospores, paraphyses and excipulum. The ecology of these genera may also distinguish them. The apothecia are more substipitate in species of *Greletia*. Although the structure of the ectal excipulum is similar in both genera, the medullary tissue is different. That in *Marcelleina* is composed of a textura intricata to textura prismatica or textura globulosa-angularis, the hyphae being densely arranged and inflated, whereas in *Greletia* the medullary layer is composed of a loose textura intricata well differentiated from the outer layer which consists of a textura globulosa. Textura globulosa similarly occurs in the ectal excipulum of *Marcelleina*, and the marginal hyphae are also similar in both genera. However, the walls of the cells are pigmented light brown in *Marcelleina*, whilst in *Greletia* these cells are purplish. The ascospores in *Greletia* contain purplish pigment and are sculptured. The sculpture is clearly observable under the light microscope in *G. verrucispora* (Donad.et Mon.) Donadini (1976,1984), *G. mulerii* Pfister (1985), *G. marchica* D.Benkert et J.Moravec (1986) and *G. reticulosperma* Donad.et Riouss. in Donadini (1986). (in the latter the sculpture readily loosens in lactic acid),whilst in *G. planchonis* and *G. ovalispora* (Grelet) Donadini (1976, 1979) the ornament is visible only with scanning electron microscopy. SEM photomicrographs reveal a fine, low sculpture. Ascospores in *Marcelleina* are hyaline and with the exception of *M. benkertii* they are sculptured. *M. donadinii* has ascospores which are smooth or bear fine to coarse cyanophilic warts on the perisporium.

The genera *Marcelleina*, *Greletia* and *Smardaea* Svr. have been placed in the family Pyronemataceae Corda emend. Korf, subfamily Ascodesmidoideae Brummelen emend. Korf (1972). However, Brummelen (1981) maintained a monotypic family Ascodesmidaceae Schroet.. I fully agree with his conclusion that *Ascodesmis* is not related to Pyronemataceae, and consider *Marcelleina*, *Greletia*, *Smardaea*, *Aleurina* Massee emend Zhuang et Korf (1986) (= *Jafneadelphus* Rifai) and *Sphaerosoma* Clotsch to belong to a subfamily *Aleurinoideae* subfam nov. However, in my opinion, the genus *Smardaea* Svrček (1969), now comprising 3 species, is congeneric with *Greletia* despite the different form of the ascospores, which are globose in the type of *Greletia* but typically ellipsoid to fusoid in *Smardaea*. However, *Greletia ovalispora* and *G.marchica* both have subellipsoid ascospores, and in the latter species the ascospore ornamentation is similar to that in *Smardaea*. However, further study of this problem is necessary. The relationships of these genera were discussed by Benkert (1980), Donadini (1985,1986), Benkert et J.Moravec (1986), Dissing (1985) and Zhuang et Korf (1986).

The main purpose of the present paper is to publish the results of my examination of several type specimens and other collections belonging to the genus *Marcelleina*.

MATERIAL AND METHODS

Specimens were examined from the following herbaria: Herbarium of the National Museum, Prague (PRM); Herbarium of Botanical Department Naturhistoriska Rijksmuseum, Stockholm, (S); Herbarium of the Royal Botanic Gardens, Kew, (K); Herbarium of Bereich Botanic und Arboretum des Museums für Naturkunde der Humboldt Universität, Berlin,(BHU); Herbarium of the Botanical Museum University of Helsinki, (H); Rijksherbarium, Leiden,(L); Herbarium of Muséum National D'Histoire Naturelle Laboratoire de Cryptogamie, Paris, (PC); Private herbaria of Mr. W.D. Graddon, Ross-on-Wye,GB,(W.D.G.). Roy Kristiansen, Torp, Norway,(Krist.); Prof. J.C.Donadini, Marseille,(Donad.) and the author's personal herbarium,(J.Mor.).

Only a few collections were examined in a fresh state. Dried material was revived in 4% aqueous NH_4OH. The sections of M. pseudoanthracina were pretreated in 2-10 % dilute KOH and stained in Melzer reagent to check the amyloid reaction of the asci or to confirm the inamyloid reaction. Sections were stained by Cotton blue Geigy s.123 in lactic acid (CB) which stains rapidly and does not require heating. Ascospores were observed and measured using an oil immersion objective at magnification x 1600. The perisporial ornamentation of ascospores in each collection was studied in greater detail and compared with each other, and especially with that of type specimens. A scanning electron microscope Tesla BS 300 was used and SEM photomicrographs were taken from dried material at a magnification x 2500, 5000 and 10 000. Excipular structure was also studied on sections stained by CB. Fuchsin in lactic acid was used for examination of asci and paraphyses.

TAXONOMIC RESULTS

Familia Pyronemataceae Corda emend Korf in Mycologia 64:948, (1972), subfamilia Aleurinoideae subfam. nov.
Typus: Aleurina Massee emend. Zhuang et Korf in Mycotaxon 26:364, (1986).
Included genera: Eoaleurina Korf et Zhuang in Zhuang et Korf (1986), Smardaea Svrček (1969), Greletia Donadini (1979), Marcelleina Brumm,.Korf et Rifai in Brummelen (1967) and Sphaerosoma Clotsch.

MARCELLEINA Brumm., Korf et Rifai in Brummelen, Persoonia, Suppl. 1:233 (1987).

Syn: Barlaeina Sacc. emend Le Gal in Rev.Mycol. 18:80, (1953)(a misapplied name - non Barlaeina Sacc. = Barlaea Sacc. = Crouania Fuck. = Lamprospora De Not. p.p.).

Pulparia Karsten (1866) emend Korf et al. (a misapplied name by Korf, Pfister et Rogers in Korf, Phytologia 21:105, (1971), Korf (1972) and other authors, e.g. Donadini (1976), Svrček (1981).

Type species: M. persoonii (H.et P. Crouan) Brumm., Included species: *M. rickii*(Rehm) Graddon, *M. georgii* (Svr.) J.Mor., *M. brevicostatispora* J.Mor., *M. pseudoanthracina* (Donad.) Krist.et J.Mor., *M. benkertii* J.Mor. and *M.donadinii* Astier et J.Mor.

Apothecia sessile, 4-10 mm. diam., pale violaceous, whitish-violaceous to brownish coloured, sometimes dark blue or dark violaceous or brown, circular in outline, sessile, shallow cupulate, patelliform to flat or pulvinate, smooth, rarely rugulose and lobed. Violaceous pigment present in paraphyses only.
Excipulum: medulary layer of dense textura intricata, the hyphae becoming inflated,towards the ectal layer forming a textura prismatica to globulosa angularis, the outer layer composed of globose cells which are elongated in the upper marginal part, forming clavate hypha-like cells. The walls of the cells of the ectal layer are yellow-brown to brownish coloured, the contents hyaline. Paraphyses ca 3 µm thick, not or slightly enlarged above, straight or commonly curved or falcate, containing violaceous or brownish pigment and often agglutinated with a brownish matter above.Asci cylindric, inamyloid, hyaline. Ascospores globose with a smooth or sculptured perisporium, hyaline, containing a single large guttule.
Habitat: On bare moist soil, especially clayey and calcareous, occasionally amongst low mosses, often on soil of banks of rivulets and brooks in meadows, parks and light woods, usually sub *Petasites*, *Tussilago*, *Filipendula* etc. in montainous areas.

A KEY TO THE SEVEN SPECIES OF MARCELLEINA

1 Ascospores perfectly smooth, or with perisporium covered by fine to coarse warts irregularly arranged and connected, forming large patches.................. 6

1* All mature ascospores sculptured...................... 2

2 Ascospore sculpture formed of isolated warts or ribs... 3

2* Ascospore ornamentation forming a complete or incomplete irregular reticulum............................. 4

3 Sculpture comprising broad warts which are irregularly rounded or angular, flat and low in the optical section; Ascospores up to 8 µm diam.. *M. pseudoanthracina*

3* Sculpture comprising isolated warts or curved irregular ribs which only rarely anastomose, appearing as ribs or spines in optical section: Ascospores broader than 8 µm.. 5

4 Ascospore reticulum mostly complete, only rarely incomplete, relatively low in optical section..*M. persoonii*

4* Ascospore reticulum mostly very incomplete, only very rarely complete, irregular, comparatively higher in optical section............................ *M. rickii*

5 Isolated warts and ribs 0.25-0.8-(1.4) µm thick, 0.3-0.7-(1) µm high; Paraphyses enlarged above.......... .... M. georgii

5* Isolated warts and ribs coarser, 0.5-1.5-(2.2) µm thick, 0.5-1.5-(1.7) µm high; Paraphyses not or very slightly enlarged above.........M. brevicostatispora

6 Ascospores perfectly smooth (even under SEM), perfectly globose, up to 12 µm diam.........M. benkertii

6* Ascospores globose to subglobose, smooth but with perisporium covered by very fine to coarse warts which are usually connected forming large patches, or with very coarse warts, especially on immature ascospores.... .... M. donadinii

MARCELLEINA PERSOONII (H.et P. Crouan) Brummelen, Persoonia, Suppl. 1:233, (1967).

Syn: Ascobolus persoonii H.et P. Crouan, Fl.Fin. p.56,(1867).
= Humaria persoonii (H.et P.Crouan) Quélet, C.r.Ass.franc. Avanc.Sci.Congress, Grenoble 1885, 14:451,(1886).
= Barlaea persoonii (H.et P.Crouan) Saccardo, Syll.Fung. 8:116, (1889).
= Plicaria persoonii(H.et P.Crouan) Boudier, Ic.Mycol.ser.I. livr.2, (1904).
= Barlaeina persoonii (H.et P.Crouan) Saccardo et Traverso, Syll.Fung. 19:137, (1910).
= Barlaea subcoerulea Kirchstein, Vehr.Bot.Ver.Prov. Brandenburg 48:46, (1906).

Apothecia 4-10 mm diam., shallow cupulate to flat or pulvinate. Hymenium bluish violaceous to violaceous becoming paler and occasionally with a brownish tinge in age, outer surface paler. Excipulum as in the generic description, the cells 15-45 µm diam.. Paraphyses 3 µm thick with only a slightly enlarged apex (4 µm) containing bluish-violaceous pigment, straight to curved, agglutinated with brownish pigment. Asci (120)-140-180-(230) x 11-12-(15) µm. Ascospores (7.5)-9-10.7 -(12) µm diam., perisporium ornamented by fine cyanophilic ridges forming a complete or sometimes incomplete irregular reticulum. The ridges only 0.25-0.5-0.7 µm wide, 0.3-0.6 µm high. (Fig. 1-4 and SEM fig. 12).

Habitat: On bare moist soil usually of the banks of rivulets, brooks, paths etc. sub Tussilago in lowlands and sub Petasites in mountains. VI-X.

Material examined:
Czechoslovakia: Bohemia, Branžež prope Mnichovo Hradiště, on bare clayey soil of a deep path under a bush of Rosaceae, near Tussilago sp., 23.VI.1968 leg. Jiří Moravec (J.Mor.); Slovakia, Mt. Belanské Tatry, near Ždiar, on moist bare soil sub Petasites hybridus on a bank of the rivulet Belá, (900 m.) 16.IX.1967 leg. J.Moravec (PRM, J.Mor.).(a collection published in J.Moravec 1969).
Norway: Gjömle near Stathelle in Bamble community, County of Telemark, on bare black soil in a partly dried rivulet, Alnus vegetation in a spruce wood, 23.VII.1982 leg. Ø.Welholt.

(Krist.,J.Mor.); Sandem Torp, Borge community, north of Fredrikstad, on a very moist soil (clay) on a rivulet bank near the Glomma river, in a bush of Rubus sp. along Tussilago, 18.VIII.-X. 1982 leg. Roy Kristiansen (Krist.,J.Mor.)- two collections; Ostfold, Borge community, Torp, on calcareous muddy clay, near Tussilago under Salix-Alnus vegetation, 7.VIII.1983 leg. Roy Kristiansen (Krist.,J.Mor). (The collection from Gjömle has smaller ascospores (7.5-9 µm). GDR: Fürstenwalde, wernsdorf, auf Asche, 13.VI.1975 leg. Dieter Benkert.

I have not examined the type specimen of Ascobolus persoonii H.et P.Crouan as it has not been available for loan. My concept of the type species of the genus is based on the examination of the type material by Brummelen (1967) who found the ascospore ornamentation in the lectotype material to be an almost complete net-work of ridges, and correctly selected the lectotype of M. persoonii in the accordance with the original description. The second part of the devided type, the smooth-spored species considered identical with Marcelleina atroviolacea (Delile ex de Seynes) Brumm., is now known under the valid name Greletia planchonis (Dun.ex Boud.) Donad.,as the basionym (Peziza atroviolacea Delile ex de Seynes) is a later homonym of Peziza atroviolacea Bres. Greletia planchonis is the type species of the genus Greletia. All collections of M. persoonii which I have examined have ascospores ornamented with an almost complete, though irregular reticulum. Some ascospores bear an incomplete reticulum, but the isolated ribs occur only very rarely. The ascospore ornamentation is the same in all apothecia of each individual collection and the species is easily recognized. This concept of M. persoonii corresponds well with the observations made by Brummelen (1967), Le Gal (1947), Svrček et Kubička (1961), J.Moravec (1969) and Pfister (1985). However, the name M. persoonii has been comonly misapplied or treated in a broader sense, which also includes M. rickii. For example, Breitenbach et Kränzlin (1981), Huhtinen (1985), and Schumacher (1979) described and illustrated ascospores with an incomplete reticulum, consisting largely of isolated ridges, which is characteristic of M. rickii.
M. persoonii sensu Dennis (1978) is identical with M. rickii. Though the illustrations in Dennis (1978, plate IV.E and fig. 1 a) show ascospores with isolate, rounded warts, reexamination of the collection from Norfolk(K) has shown to be the same as in the type of M. rickii.
M. persoonii sensu Nemlich et Avizohar-Hershenzon (1975) is, based on the description, illustration and habitat, evidently Greletia planchonis.

Barlaea subcoerulea Kirchstein (1906) is a synonym of M. persoonii. According a letter sent to me by the curator of the herbarium of the Museum in Dahlem (D), the type no longer exists. However, a slide prepared from the type material several years ago by Dr. D. Benkert does still exist and was sent to me. This has shown it to be identical with M. persoonii.

M. persoonii sensu Velenovský (1934) is identical with M. rickii.

MARCELLEINA RICKII (Rehm) Graddon, Trans.Brit.Mycol.Soc. 66:170, (1976).
Syn: *Detonia rickii* Rehm, Hedwigia 38:243, (1899).
= *Pulparia rickii* (Rehm) Donadini, Bull.Soc.mycol.Fr. 95:183, (1979).
= *Lamprospora jetelae* Vacek,Stud.Bot.Čechoslov. 10:133, (1949).
= *Pulparia jetelae*(Vacek) Svrček, Čes.Mykol. 35:88, (1981).
= *Pulparia amethystina* (Quél). Nemlich et Avizohar-Hershenzon sensu Svrček pro parte, Čes.Mykol. 35:75, (1981)= *Barlaea persoonii* sensu Velenovský, Mon.Disc. Boh.Pragae, p.321, (1934) = *Marcelleina persoonii* sensu Dennis, Brit.Ascom. Vaduz, p.31, (1978) - misapplied names.

Apothecia 3-6-(10) mm diam., sessile, shallow cupulate to flat or pulvinate, hymenium flesh coloured to pale violaceous, whitish or pale clay-ochraceous to brownish (according to the original diagnosis "carneo-flavida"), outer surface of the same colour or paler. Excipulum and asci as in *M. persoonii*. Paraphyses 3-4 µm thick, apex enlarged to 5-6.5 µm, curved, with pale violaceous-brown pigment. Ascospores 7.5-8-9.7-(10.3) µm,diam.(in asci with a reduced number of ascospores they may reach up to 12 µm diam.), the perisporium bearing reticulum which is very irregular and incomplete or rarely complete but then very irregular, formed of sharper ribs than in *M. persoonii*. The ribs are 0.3-0.8-1.4 µm thick, 0.3-0.8-(1.2) µm high. (Figs. 5-6 and SEM Fig.13).

Habitat: On bare clayey soil, calcareous or rarely sandy soil occasionally associated with low mosses, sub *Petasites*, *Tussilago*, *Filipendula*, Juncus etc., VI-VIII.

Material examined:

Austria: Vorarlberg, apud Feldkirch, ad terram lutosam leg. Zurhausen. Rehm 1263, (1899)- the type of *Detonia rickii* Rehm (S).
Czechoslovakia: Bohemia, prope Bilichov, in terra argillacea aquosa, VI. 1925 leg. Josef Velenovský (PRM).(= *Barlaea persoonii* sensu Velenovský 1934); Bohemia, Branžež near Mnichovo Hradiště, on bare moist clayey soil of the wall of a bank of a brook in a meadow, sub Juncus and Filipendula, 2.VI. 1968 leg. Jiří Moravec (J.Mor.); Slovakia, Mt. Belanské Tatry (700 m), near Ždiar, on moist bare soil of the bank of the rivulet Belá, 12.VI.1970 leg. J.Moravec (J.Mor,); Slovakia, Mt. Západné Tatry-Roháče (West Tatras), district of Dolný Kubín- three collections: Látaná dolina prope Zverovka, on calcareous soil near road in spruce forest sub Petasites alba, 22.VII.1987,; Juráňova dolina prope Oravice, on clayey moist soil near a brook sub *Petasites* sp. on the rivulet bank, 24.VII.1987, Bobrovecká dolina- Vaničky near Oravice, on clayey moist soil near a brook, sub *Petasites* sp. 25.VII.1987 leg. J.Moravec (J.Mor.);
Bulgaria, Etăra near Gabrovo, on sand of a rivulet bank in deciduous forest sub *Petasites* sp., 3.VIII.1987 leg. J.Moravec (J.Mor.).
Great britain: Long Compton, Warwks, on mossy soil, VII.1970

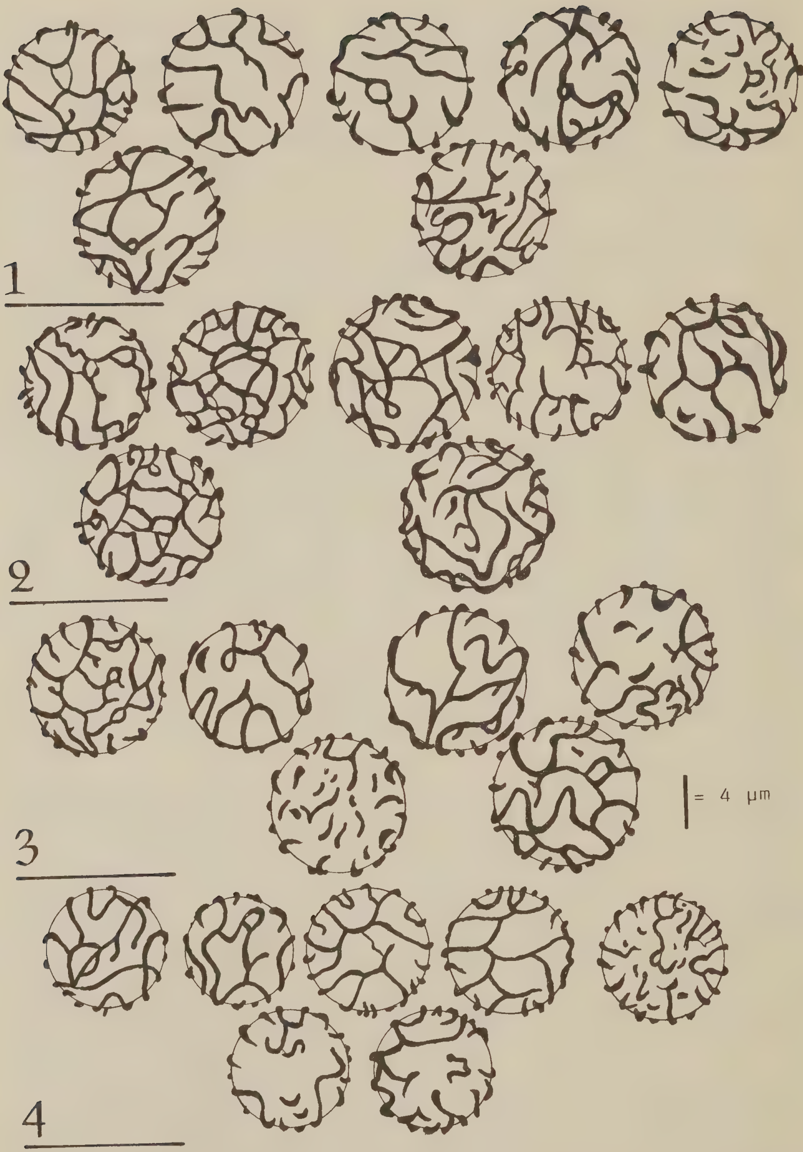


Fig. 1-4: *Marcelleina persoonii*. 1. Czechoslovakia, Bohemia, Branžež, 23.VI.1968 (J.Mor.); 2. Norway, Torp, 18.VIII.1982 leg. R.Kristiansen (Krist.,J.Mor.); 3. Czechoslovakia, Slovakia, Mt. Belanské Tatry near Ždiar, 16.IX.1967 (J.Mor.); 4. Norway, Gjömle, 23.VII.1982 leg.Ø. Welholt (Krist.,J.Mor.). Ascospores under oil immersion + CB.

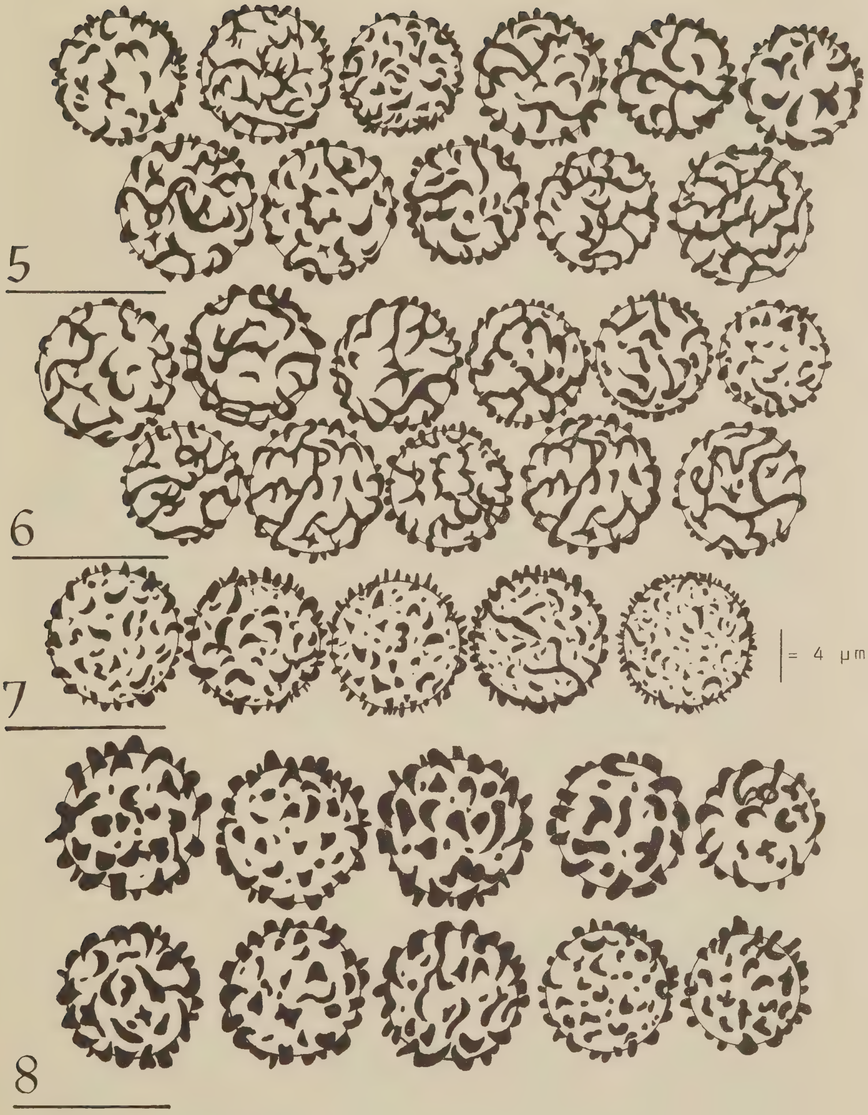


Fig. 5-8: Ascospores under oil immersion + CB.
5. Marcelleina rickii (type of Detonia rickii),(S);
6. M. rickii (holotype of Lamprospora jetelae),(PRM) ;
7. M. georgii, (neotype BRA);
8. M. brevicostatispora (holotype PRM).

leg. M.C.Clark (W.D.G.) (published in Graddon 1976); Wheatfen Broad, Norfolk, on humus and roots in swamps under Glyceria, Juncus and Filipendula, also on bare soil under Tussilago, VII - 16.VIII.1947 leg. R.W.G.Dennis (K) (= M. persoonii sensu Dennis 1978);
GDR: Rügen, Wissower Klinken, auf Kreide, 20.9.1985 leg. D.Benkert (BHU); Worbis, Wintzingerode, auf Lehm, 8.IX.1981 leg. D.Benkert (BHU);

All collections examined have ascospores with ornamentation similar to that in the type of Detonia rickii. M. rickii is, in my opinion, a distinct species differentiated from M. persoonii by the more incomplete ascospore sculpture. Though ascospores with an almost complete reticulum occasionally occur, the majority of ascospores have a very incomplete and irregular reticulum, consisting of curved ribs. The ribs are coarser, more curved and sharp, and of a different shape than these of M. persoonii. A small number of ascospores have the ribs merely isolated and short.
The species has been almost unknown even to recent authors, though Graddon (1976) perfectly described and illustrated the British collection. The color of the apothecia varies from pale violaceous to whitish to clay-brownish. Individual collections may have apothecia of violaceous colour growing together with others, which are brownish. My experience agrees well with observations made by Dr.Benkert and R.Kristiansen (in litt.). The most distinctive feature for determination of this species is the ascospore ornamentation. The colour of apothecia, considered a distinctive feature for determination (Graddon (1976), is not , according to our observations, a reliable feature.
All the collections examined were collected in summer, and it seems that the fruiting time differs from that in other species.
As it was already noted, M. persoonii sensu Dennis (1978) is identical with M. rickii. I have also reexamined the collection of M. persoonii sensu Velenovský (1934) and found it identical with M. rickii, though Svrček (1981) placed it into synonymy with P. amethystina, an insufficiently known taxon. M. persoonii sensu Breitenbach et Kränzlin (1981), Huhtinen (1985) and Schumacher (1979) may be M. rickii judging by the illustrated ascospores.
Lamprospora jetelae Vacek (1949) was described with dirty-white to pale ochraceous apothecia. I have reexamined the type (PRM) which contains only one mature apothecium intermixed with several apothecia of a species of Scutellinia. The ascospore ornamentation (Fig 6 and SEM Fig. corresponds well with that in the type of Detonia rickii, as does the colour of the hymenium, and I consider L. jetelae a synonym of M. rickii. (I found whitish apothecia growing together with violaceous and brownish apothecia in several collections of M. rickii).

MARCELLEINA GEORGII (Svrček) J.Moravec comb. nov.

Basionym: Lamprospora georgii Svrček, Čes.Mykol. 12:229, (1958).
Syn: Pulparia amethystina (Quél.) Nemlich et Avizohar-

Hershenzon sensu Svrček pro parte, Čes.Mykol. 35:75, (1981).

Apothecia 3-10 mm diam., sessile, shallow cupulate to flat or pulvinate, hymenium pale violaceous or whitish-violaceous in age, occasionally with a brownish tinge, or whitish. Excipulum and asci as in M. persoonii. Paraphyses 3-4 µm thick, apex enlarged to 5-9 µm, curved, containing a pale violaceous pigment. Ascospores 7.5-9.7-(10.4) µm diam., hyaline, perisporium with weakly cyanophilic isolated warts, spines or very short ribs which are only very rarely anastomosing and elongated. The ribs measure 0.25-0.8-(1.4) µm thick, 0.2-0.7-(1) µm high. (Fig. 7 and SEM fig.14).

Habitat: On bare moist soil, often sandy soil on the beds of rivulets and banks of brooks in mountainous areas sub Petasites,(VII)-VIII-X.

Neotype: Czechoslovakia: Slovacia, Mt. Belanské Tatry,Ždiar, ad ripam rivuli Belá, sub Petasites sp. ad terram humidam nudam arenosam, 16.IX.1967 leg. Jiří Moravec. (BRA) neotypus, duplicatum in (J.Mor.).

Type locality: Slovacia septentrionalis, montes Belanské Tatry, ad terram humidam nudam in Petasiteto, 1.VIII.1956 leg. Jiří Kubička (Svrček 1959) (not located in PRM).

Other collections examined: Slovakia,Mt. Slovenský Raj, near Čingov, district of Spišská Nová Ves, on moist bare sandy soil on a bank of the rivulet Bielý potok, 3.X.1986 leg. J.Moravec (J.Mor.); Slovakia, Mt. Západné Tatry-Roháče, near Oravice, district of Dolný Kubin, on moist bare soil of a bed of a rivulet, 24.VII.1987 leg. J. Moravec (J.Mor); Moravia, Adamov near Brno, on bare moist sandy soil of a bank of the rivulet Křtinský potok, 27.IX.1972 leg.J.Moravec (J.Mor.). All collections sub Petasites sp.
Norway: Østfold, Hvaler community, Kirkøy, Engen, on lusk soil (calcareous) near Betula, Quercus and Populus, 15.IX. 1986 leg. Roy Kristiansen (Krist., J.Mor.);
GDR: Rügen, Stubnitz, Steilküste bei Schnaks Ufer, auf feuchter Kreide unter Tussilago, 21.IX.1985 leg. D.Benkert (BHU)

M. georgii is related to M. rickii but differs distinctly in ascospore ornamentation, which consists of mostly isolated warts or spines, or short, often spine-like ribs. The sculpture is much less cyanophilic than in other species. The paraphyses are more enlarged above and the fruiting time is later, usually in autumn. The type no longer exists in PRM but the selected neotype is a collection from the same mountainous area as the type.

Pulparia amethystina (Quél.) Nemlich et Avizohar-Hershenzon, based on Humaria persoonii var. amethystina Quélet (1886), cannot now be identified. The type material does not exist and it is quite impossible to decide wheather it was a species of Marcelleina or Greletia. The ascospore ornamentation of all species, including M. persoonii was, as a result of poor staining methods, described as verrucose and illustrated with rounded, isolated warts (e.g.Boudier 1905). It is therefore impossible to recognize *M. amethystina* as an indipendent taxon on the basis of "isolated warts" on the ascospores. According to the original diagnosis (Quélet 1886), this fungus had rather small apothecia (3-4 mm) and ascospores with fine rounded warts (spore sphérique (12 μm), ornée de petites verrues globuleuses"). Such ornamentation was illustrated in ascospores of *Barlaeina amethystina* sensu Maas Geesteranus (1967) but reexamination of this collection (L) has revealed that the fungus is *Ascobolus brassicae* Crouan. The amyloid reaction of the asci of *A. brassicae* may be easily overlooked and it may be disdetermined.

MARCELLEINA BREVICOSTATISPORA J.Moravec, Čes.Mykol.25:198, (1971).

Apothecia 5-10 mm diam., sessile, shallow cupulate to expanded, hymenium and outer surface blue-violet, becoming dark blue, margin paler. Excipulum as in the generic description, the cells of the ectal layer 13-55 μm diam.. Asci as in *M. persoonii*. Paraphyses 2.5-3.5 μm diam., slightly curved above, apex not or slightly enlarged (up to 4 μm), with violaceous pigment. Ascospores 8-9.7-10.2-(11.5) μm diam., with a perisporium bearing strongly cyanophilic, coarse, isolated warts or very short ribs which are only rarely longer and anastomosing. The warts and ribs measure 0.5-1.5-(2.2) μm thick, 0.5-1.5-(1.7) μm high. (Fig.8 and SEM fig.15).

Habitat: On bare moist soil, also sub *Petasites*, known from 2 localities.

Material examined:
Jugoslavia: near Ilidža, District of Sarajevo, on humid soil in a plane-tree avenue along the road, 12.VII.1969 leg. J. Moravec (Holotype PRM 710001, isotype J.Mor.).
Czechoslovakia: Moravia, Adamov near Brno, on a calcareous sandy soil of the bank of the rivulet Křtinský potok, under *Petasites albus*, 23.IX. 1972 leg. Jiří Moravec (J.Mor.).

M. brevicostatispora has ascospores with a similar ornamentation to that of *M. georgii*. However, the ornamentation is much more cyanophilic, coarser, and higher as seen in optical section. Moreover, the paraphyses are much narrower, not or only slightly enlarged above, and the apothecia are of a different colour, becoming dark blue in age.

MARCELLEINA PSEUDOANTHRACINA (Donadini)Kristiansen et J.Moravec comb. nov.
Basionym: *Peziza pseudoanthracina* Donadini, Doc.Mycol.12, fasc.46:6, (1982).
= *Plicaria anthracina* (Cooke)Boud. sensu Boudier, Hist. Class.Discom.Eur. 50,(1907); Icon.mycol., livr. 19,N° prov.371, (1908) (2:pl.307, 4:170), a misapplied name.

Apothecia 3-7 mm diam., turbinate, shallow cupulate to pulvinate and often irregular, hymenium flesh colour to deep purple to blackish purple, brown-lilac or greenish black, outer surface paler. Excipulum under the subhymenium poorly developed, of a textura intricata grading to textura prismatica-angularis of medullary excipulum consisting of cells 8-15-20 µm diam. grading into elongated clavated cells 12-18 µm broad with brownish walls towards the ectal surface and margin. Paraphyses 4 µm diam., enlarged up to 6 µm above, straight or only slightly curved, containing brownish or rarely brownish-violaceous pigment. Asci 180-260 x 8-9-12.5

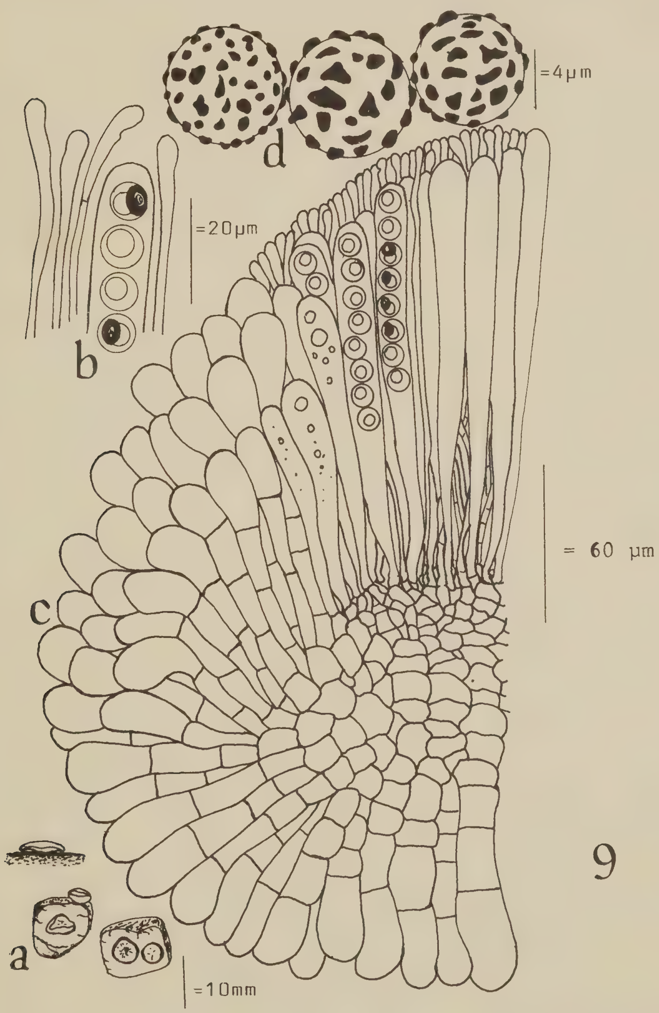


Fig. 9: Macro and microfeatures of Marcelleina pseudoanthracina. a. apothecia; b. part of ascus and paraphyses; c. section of the marginal part of the apothecium; d. ascospores under oil immersion + CB.
The collection BHU.

µm inamyloid. Ascospores 7-8.5 µm diam., with one large guttle and occasionally with de Bary bubbles, perisporium ornamented with low,irregularly rounded to angular, isolated or rarely connected weakly cyanophilic warts 0.5-1.5 µm wide, 0.2-0.5 µm high.(Fig.9 and SEM fig.16).

Habitat: On clayey soil sub Tussilago, Taraxacum; also on burnt soil (?) VII.-X.

Material examined:
Norway: North of Leka, Moum, Torp, near the Glomma river, Borge community, North of Friedrikstad, County of Øsfold, on bare clayey soil and on clay mixed with pieces of bricks among Tussilago, Taraxacum, Cirsium sp. sub Alnus,Populus tremula, Salix, Sambucus, Sorbus and Betula (a dried swamp area), 31.VII.-VIII.1982 leg. Roy Kristiansen; near the same locality, on soil along a wheel track sparsely with a moss, Urtica, Salix and Alnus, 18.VIII.- X. 1982 leg. Roy Kristiansen (Krist.,J.Mor.).
GDR: Bernan, Krisgruber Schvaneberk-Alpenburge, 14.VI.1978 leg. Paechnitz (BHU).

This fungus, which has been known under the name Plicaria anthracina sensu Boudier (1907), was incorrectly placed in Peziza by Donadini (1982), who erroneously stated the asci to be amyloid. Boudier (1907,1908) has previously described the asci as inamyloid. Boudier's collection was examined by Maas Geesteranus (1967) who found it to be inrelated to Peziza anthracina Cooke and confirmed the asci to be inamyloid. A collection from GDR was examined by Hirsch (1985) who summarized earlier work and pointed out Donadini's error. He correctly suggested that the proper place for this fungus is in the genus Pulparia (= Marcelleina). However, his note that this fungus may fall into synonymy with M. rickii, similarly as previously suggested by Graddon (1976), was incorrect. Sections of these two collections pretreated in 2-10 % KOH and stained in Melzer reagent have confirmed that the asci are non-amyloid.
M. pseudoanthracina has a rather isolated position in the genus, and, as suggested by Kristiansen and Sivertsen (in litt), may represent a new genus. However we think that the characters of this species, notably gelatinous apothecia and de Bary bubbles in the ascospores as well as the more elongated cells of the ectal excipulum and the straight, clavate paraphyses with little if any violaceous pigment, are not sufficiently different for erection of a new genus to accomodate it. M. pseudoanthracina shows a certain affinity with the genus Sphaerosoma Klotzch,which was studied recently by Dissing et Korf (1980), but this genus differs from Marcelleina in several features, especially in its shape of apothecia which are subglobose without the margin. Moreover, the asci in Sphaerosoma are very broad.

M. pseudoanthracina is a very rare species with only few collections in Europe. However, the collections in Norway were very rich with about 160 apothecia growing on one place (Kristiansen in litt.). The colour of apothecia seems to be very variable as it is also seen in colour photographs made by Roy Kristiansen.

MARCELLEINA BENKERTII J.Moravec spec. nov.

Apothecia 5-9 mm diam., leniter patellaria, dein plana, usque irregulariter lobato-pulvinata, disco saepe ruguloso, hymenio violaceo, obscure violaceo, usque atroviolaceo, extus subglabra, pallide violacea. Excipulum parte inferiore sub hymenio - textura intricata sed valde atypica, e hyphis septatis, inflatis ad textura prismatica-angularis, parte medullari e textura angulare, excipulum externum - textura angularis-globulosa e cellulis saepe pyriformibus,marginemque parte superiori apothecii e cellulis elongatis, clavatis, cum tunica brunnea constat. Paraphyses filiformes, septatae, basi ramosae, apice non incrassatae vel sensim incrassatae, curvatae vel saepe falcatae et breviter furcatae, pigmento violaceo impletae. Asci cylindracei, hyalini, tunica non amyloidea. Ascosporae globosae, 9-12 µm diam., hyalinae, laeves.
Holotypus:Czechoslovakia, Bohemia, non procul Branžež prope Mnichovo Hradiště, ad terram argillaceam nudam et inter muscis humiliis in fossa sub dumeto, 15.X.1966 leg. Jiří Moravec (BRA). (IsotypusJ.Mor.).

Apothecia 5-9 mm diam., shallowly patelliform to flat, becoming irregularly lobate and pulvinate, disc often rugulose, hymenium violaceous, dark violaceous to black-violaceous, paler when dried, outer surface almost smooth and paler, whitish when dried. Excipulum in a thin layer under hymenium of atypical textura intricata, composed of septate hyphae 4-8 µm thick, often inflated and grading into textura prismatica-angularis, medullary excipulum of textura angularis composed of angular cells, grading into subglobose cells in the ectal layer, the cells 15-30-50 µm diam. with brownish walls; ectal surface towards the margin of the apothecia composed of hypha-like elongate to clavate cells which are 6-15 µm thick above, hyaline having the walls light yellow-brown coloured. Asci 190-250 x 12-16.5 µm, cylindrical, hyaline, eight-spored, the spores in immature asci biseriate, in matured asci uniseriate, inamyloid. Paraphyses filiform, 3-3.3 µm thick, branched below, septate, apex not or slightly enlarged to 3.5-4.5-(5) µm, usually curved or falcate, containing pale violaceous pigment and agglutinated by a brownish excreted matter. Ascospores 9-10-11.4-(12) µm diam., perfectly globose, hyaline, with one large guttule,perfectly smooth. (Fig. 10 and SEM fig.18).

Habitat:Czechoslovakia, Bohemia, near the village Branžež near Mnichovo Hradiště, on bare moist calcareous soil and also amongst low moss, in a ditch under a bush (Rosaceae), 15.X.1966 leg. J.Moravec. (Holotype BRA, isotype J.Mor.). Other material examined: GDR: Rügen, Steilküste bei Schnaks Ufer, auf Kreide, 21.IX.1985 leg. Dieter Benkert (BHU); Rügen,Steilufer südlich Vitt, auf tonigen Stellen, 19.IX. 1985 leg. Dieter Benkert (BHU).

Misapplied name: Marcelleina planchonis (Dunal ex Boud.) J.Moravec, Čes.Mykol. 23:233, (1969 a).

M. benkertii differs from all known species of Marcelleina in the perfectly smooth ascospores. Moreover, the apothecia excipular structure and paraphyses are similar to those of other species of Marcelleina. In my opinion,these distinctive characters are not sufficient for establishment of a new genus. Previously, I reported this fungus incorrectly under the name M. planchonis (J.Moravec 1969 a). M. benkertii differs clearly from G. planchonis and other species of Greletia by the absence of purplish pigment in asci, paraphyses and excipulum and, by the ascospores which are smooth even when observed under the scanning electron microscope at magnification x 10 000.

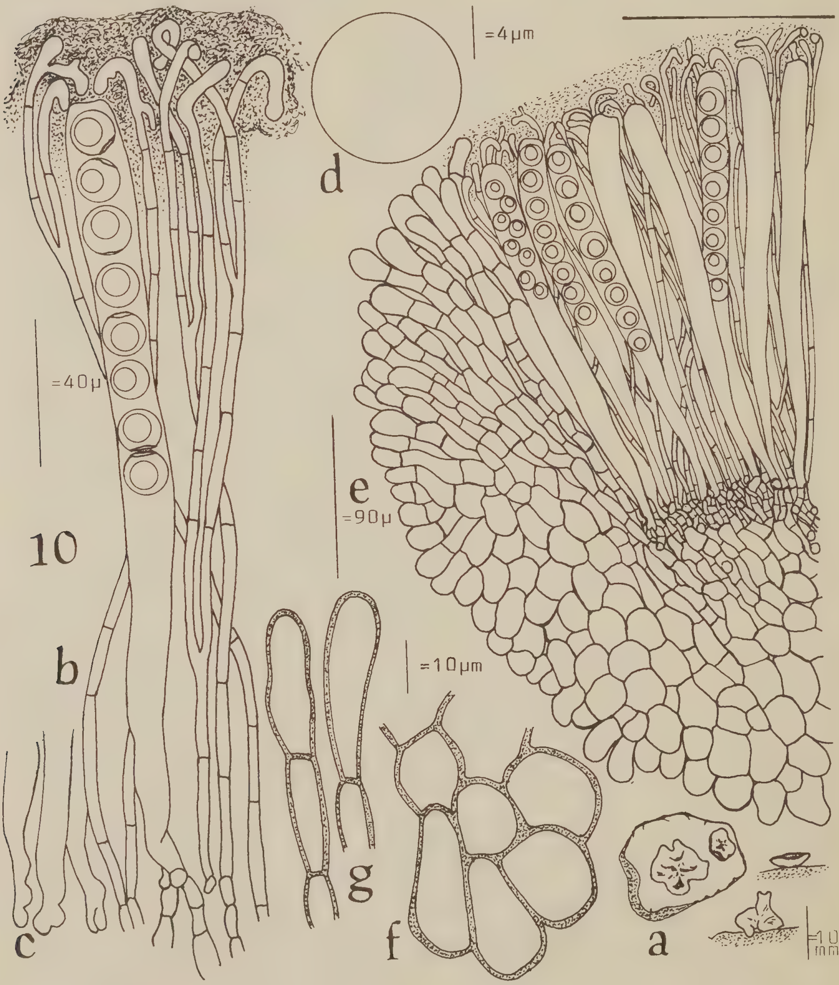


Fig. 10: Macro and microfeatures of Marcelleina benkertii. a. apothecia; b. ascus and paraphyses; c. base of asci; d. ascospore under oil immersion +CB; e. section of the apothecial margin; f. cells of the ectal excipulum; g. marginal cells. (Holotype BRA).

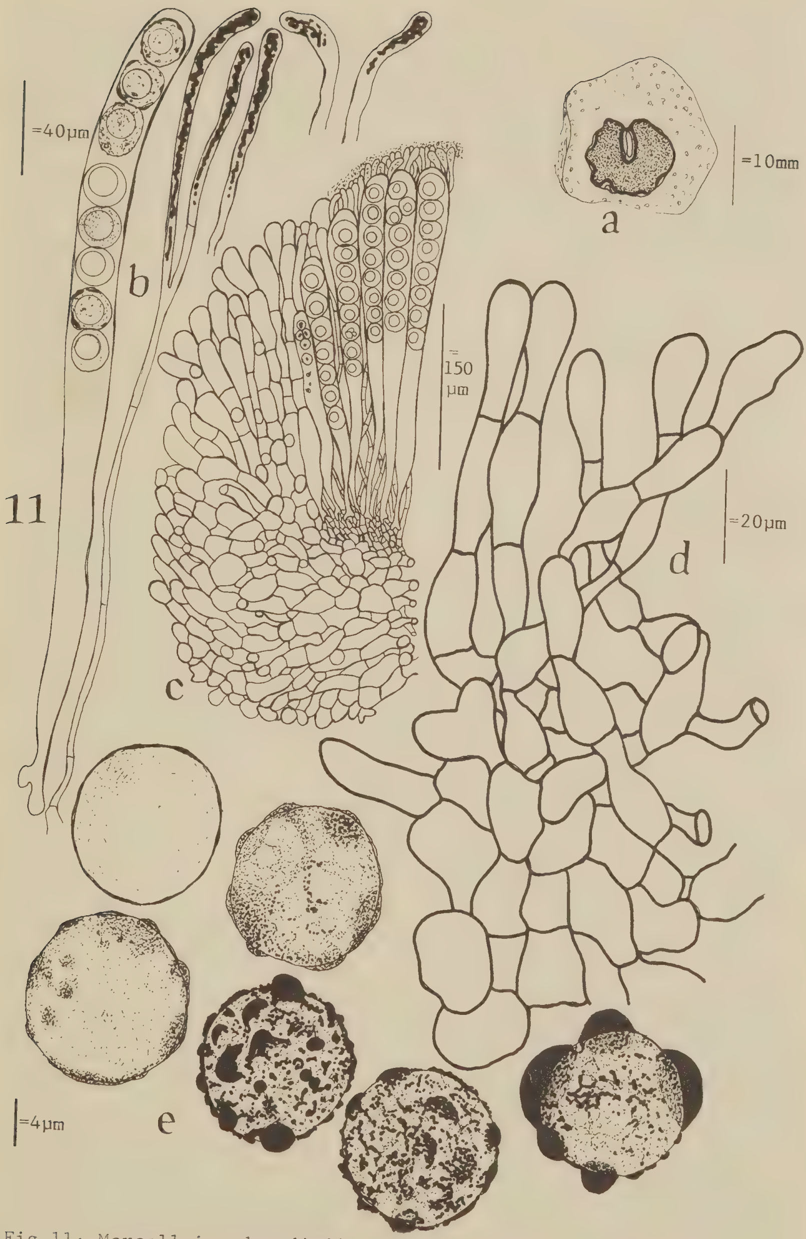

11
a
=10mm
b
=40µm
c
=150 µm
d
=20µm
e
=4µm

Fig 11: Marcelleina donadinii. a. apothecium; b. ascus and paraphyses; c. section of the marginal part of the apothecium; d. marginal cells and cells of the ectal excipulum; e. ascospores under oil immersion + CB. Isotype (BRA).

I have not examined the type *Peziza atroviolacea* Delile ex de Seynes (1886), now considered identical with *G. planchonis*, but this taxon is invalid, as noted in the introduction of this paper. I have examined the collection of *G.planchonis* from Australia published by Rifai (1968) under the name *Marcelleina atroviolacea* (K). It contains violaceous pigment throughout the entire apothecium as in the type and all other collections I have examined. The type of *Barlaea cookei* Massee apud Crosland, based on *Peziza violascens* Cooke from the herbarium of W.Phillips (K) contains no apothecium of the fungus described by Cooke (1876), as Dr. Brummelen who examined the type from K kindly informed me. Cooke's plate (21, fig.83) clearly shows the violaceous pigment present in the whole fungus.
The type of *Pulparia arctica* Karst. differs in its whitish apothecia (described with a bluish tinge), habitat, narrower and differently shaped paraphyses and in all other features, and, is not congeneric with *Marcelleina*. The result of an examination of the type of *P. arctica* is to be published by Dissing (in press).

MARCELLEINA DONADINII Astier et J.Moravec spec. nov.

Apothecia usque 10 µm diam., sessilia, leniter patellaria, dein discoidea, marginemque irregulariter lobata, thecio griseo-violaceo dein nigro-violaceo, extus pallida, basi sordide alba sed margo obscure violaceo, subglabra. Excipulum parte inferiore - textura intricata,e hyphis septatis, irregulariter inflatis, parte medullari textura angulari formantes, excipulum externum - textura angularis,marginemque parte superiori apothecii e cellulis elongatis, clavatis, laete fuscis. Paraphyses filiformes, apice sensim vel valde incrassatae, septatae, rectae vel sensim curvatae, pigmento obscure violaceo impletae. Asci cylindracei, octospori, non amyloidei. Ascosporae globosae vel sensim subglobosae, 10.5-15.5 µm diam. vel 13.5-16 x 12.5-15 µm, hyalinae, cum guttula unica excentrica magna, laeves vel sublaeves vel perisporio dense subtiliter irregulariter verruculoso, saepe cum verrucis crassis, valde cyanophilis donato.

Holotypus: France, St. Jean de Garguier prope Marseille, XII.1984 leg. Joseph Astier (PC). Isotypus: BRA et duplicata in herbaria privata J.Astierii at J. Moravecii.

Apothecia up to 10 mm diam., sessile, shallowly patelliform to flat, with irregularly lobed margin, hymenium greyish-violaceous, becoming black-violaceous, outer surface paler, dirty whitish towards the base, with violaceous margin. Excipulum a textura intricata composed of septate hyphae which are irregularly inflated to form angular cells 8-30 x 8-15 µm diam., and forming textura angularis in the medullar tissue and ectal layer; the ectal layer towards the margin of the apothecia is composed of elongated cells which are clavate in their upper part, 7-15 µm diam, yellowish to pale yellow-brown coloured. Paraphyses filiform, 3-4 µm diam., septate, straight or slightly curved above, with enlarged (4.5-7.5 µm) tips, containing dark brown pigment with a slight violaceous tinge and agglutinated by brownish excreted matter. Asci cylindrical, hyaline, eight-spored,(the spores in immature asci biseriate, later uniseriate), inamyloid, 300-400 x 16.3-24 µm. Ascospores globose 10.5-

13.5-15.5 µm diam., or subglobose (irregularly shaped), 13.5-16 x 12.5-15 µm (excluding the sculpture), containing one large excentric oil guttule, smooth, or perisporium (under light microscope) covered by dense, irregularly arranged,fine, cyanophilic warts (0.1-0.3 µm diam.), forming irregular large patches of connected warts. However, ascospores with rather coarse warts (usually 0.5-1.5 µm diam.) also occur. Immature and submature ascospores have the perisporium covered by huge pustules of cyanophilic pigment up to 4 µm wide and 2 µm high. The ornamentation is clearly observed under scanning electron microscope x 5000-10 000. (fig.11 and SEM fig. 17).

Habitat: France, near Marseille, at St.Jean Garguier, December 1984 leg. Joseph Astier (Holotype PC, Isotype BRA and Ast., J.Mor.). A previous collection (December 1982) from the same locality and collector was not deposited in herbaria.

The collection of this species was previously reported by Astier (1985).

M. donadinii is related to *M. benkertii*. The violaceous colour of the hymenium (also seen on the colour slides made by J.Astier) is similar in both species. However, *M.donadinii* clearly differs in its ascospores which are larger and of a much more irregular shape (subglobose or irregularly subangular) than those of *M. benkertii*, which are perfectly globose and smaller. Moreover, the ascospores of *M.benkertii* are perfectly smooth, whilst in *M. donadinii* they usually have a very conspicuous sculpture as described above. It is interesting that the perisporium of immature ascospores, covered by huge cyanophilic pustules, is similar to that in immature ascospores of *Sowerbyella*. The sculpture of the perisporium of ascospores of *M. donadinii* loosens after a prolonged treatment in lactic acid. This feature is similar to that in *Greletia reticulosperma*.
In my opinion, *M. donadinii* is a transitional species between those with fully sculptured ascospores and the smooth spored *M. benkertii*. The ascospore sculpture as seen on SEM micrographs is rather similar to that in ascospores of *Greletia planchonis* and *G. ovalispora* and also in *G. reticulosperma*. However, M. *donadinii* differs by the absence of purplish pigment in asci, paraphyses and excipulum, and, has all fetures of *Marcelleina*.

I have examined the type material of most species of *Greletia*: *G. planchonis*, *G.marchica*, *G.verrucispora* and *G. reticulosperma*, and also other collections including a collection of *G. ovalispora* from Spain. The isotype of *G. verrucispora* was kindly sent to me by Dr. H.Dissing. It is identical with the holotype, though the SEM photomicrographs of ascospores published by Donadini (1976) are rather different from those of the isotype published later by Donadini(1984). Reexamination of both has confirmed that *G. verrucispora* is distinct from *G. marchica* as previously noted by Benkert et Moravec (1986).The differences are in ascospore size, and, especially in ascospore ornamentation.
In addition, I have examined the type specimens of *Peziza lobata* Berk.et Curt. apud Berkeley (1868) and *Peziza verrucu-*

losa Berk.et Br. (K) and I consider them not to be congeneric with *Marcelleina*.

The 7 species of *Marcelleina* are easily recognizable.

M. *persoonii*, *M*. *rickii*, *M*. *georgii* and *M*. *brevicostatispora* are closely related to each other but can be determined on the basis of ascospore ornamentation. The ascospore ornamentation is consistent in all apothecia of each individual collection and different in each species.

Though we know little about speciation in Discomycetes, I am convinced that the 7 taxa presented here are discrete species not distinct merely at infraspecific level.

The key published in this paper sumarizes these results and will serve for determination of the species based on microfeatures. All the measures of ascospores in this paper are given without the ascospore ornamentation.

ACKNOWLEDGEMENTS

I thank Dr.Dieter Benkert (Berlin,GDR) and Roy Kristiansen (Torp, Norway) for their kind help in providing specimens for my examination and valuable data and notes. I thank also Dr. Z.Pouzar, Dr. M.Svrček (Prague), Dr. Spooner (Kew), Mr. W.D.Graddon (Ross-on Wye), Dr.A.Strid (Stockholm), Dr. R. Cailleux (Paris), Dr. R.A.Maas Geesteranus (Leiden), Dr. H. Dissing (København) and Dr. H.Harmaja (Helsinki) for the loan of types or other specimens from their herbaria.

I am very much obliged to Mr. J.Lhotecký who prepared the SEM photomicrographs in the university of Agriculture, Brno. Dr. B.M.Spooner (Kew) kindly read the manuscript.

REFERENCES

Astier,J.,1985: Two species probably new. Marcelleina sp.nov. or Pulparia sp. Poster of The Congress of European mycologists CEM 4 1985, Oslo.

Benkert,D. et J.Moravec,1986: Greletia marchica spec.nov. anew discomycete (Pezizales) from GDR. Mycol.Helvet.2 (1):87-92.

Berkeley,M.J.,1868: On a collection of fungi from Cuba. Part II. J.Linn. Soc.Bot. 10:341-392.

Boudier,E.,1907: Histoire et clasification des Discomycètes d' Europe. Paris.

Boudier,E.,1908: Icones mycologicae ou iconographie des champignons de France. Paris.

Breitenbach,J.et F.Kränzlin,1981: Champignons de Suisse. Tome 1. Lucerne.

Brummelen,J.van, 1967: A world-monograph of the genera Ascobolus and Saccobolus (Ascomycetes,Pezizales). Persoonia (Suppl.) 1:1-260.

Brummelen,J.van,1981: The genus Ascodesmis (Pezizales,Ascomycetes). Persoonia 11 (3):333-358 .

Cooke,M.C.,1876: Mycographia,seu icones fungorum.I. part 2:45-90, pl.21-40. London.

Dennis,R.W.G.,1978: British Ascomycetes. Vaduz.

Dissing,H.,1985: Smardaea purpurea (Pezizales) another new species from Graubünden, switzerland. Sydowia,Ann.Mycol.ser.II, 38:35-40.

Dissing,H.et R.P.Korf,1980: Preliminary studies in the genera Ruhlandiella, Sphaerosoma and Sphaerozone (Order Pezizales). Mycotaxon 12:287-306

Donadini,J.C.,1976:Le genre Pulparia Karsten en France.Rev.Mycol.40:255-272.

Donadini,J.C.,1979:Un genre nouveau:Greletia nov.gen.(ex Pulparia Karsten emend.Korf pro parte.Pezizales). Bull.Soc.Mycol.Fr. 95:181-184.

Donadini,J.C.,1982: Rappels,validation et commentaires sur quelques taxa.

Doc.Mycol. 12 (46):1-7.
Donadini,J.C., 1984: Etude cytologique des discomycetes (1) Les genres Greletia et Pulparia (Pezizales). Bull.Soc.Linn.Provence,Marseille, 35:139-151.
Donadini,J.C.,1985: Discomycetes (2) Cytologie, taxonomie et phylogenie (Aplications à Hypotarzetta g.nov.,H.insignis c.nov., Humariaceae et Pyronemataceae. Doc.mycol. 15 (60):47-57.
Donadini,J.C.,1986: Scanning des asques et cytologie Greletia reticulosperma n.sp. Doc.Mycol. 16 (62):53-65.
Graddon,W.D.,1976: Discomycete notes and records. Trans.Brit.Mycol.Soc. 66:169-172.
Huhtinen,S.,1985: Mycoflora of Poste-de-la-Baleine, Northern Québeck Ascomycetes. Naturaliste can. (Rev.Ékol.Syst.), 112:473-534.
Hirsch,G., 1985: The genera Scabropezia and Plicaria in the German Democratic Republic. Agarica 6 (12):241-258.
Karsten,P.A.,1871: Mycologia fenica. Pars prima: Discomycetes. Bidr.Känn. Finl.Nat.Folk. 19:1-264.
Kirchstein,W.,1906: Neue märkische Ascomyceten. Vehr.Bot.Ver.Prov. Brandenburg 48:39-61.
Korf,R.P.,1972: Synoptic key to the genera of the Pezizales. Mycologia 64:937-994.
Le Gal, M.,1953: Les Discomycètes de l'herbier Crouan. Rev.Mycol. 18:73-132.
Le Gal,M.,1947: Recherches sur les ornamentations sporales des Discomycètes operculés. Ann.Sci.Nat.Bot.sér.11, 8:73-297.
Maas Geesteranus,R.A.,1967: Studies on cup-fungi-I. Persoonia 4:417-425.
Maas Geesteranus,R.A.,1967a: De fungi van Nederland. 2a. Pezizales-deel I. Wetensch.Mededel.Kon.Ned.Nat.Ver.. Leiden. 69:1-72.
Moravec,J.,1969: Několik operkulátnich discomycetů z Vysokých Tater, Belanských Tater a Spišské Magury na Slovensku. Čes.Mycol.23 (1):24-34.
Moravec,J.,1969a: Některé operkulátní diskomycety nalezené v okresech Mladá Boleslav a Jičín. Čes.Mykol. 23 (3):222-235.
Moravec,J.,1971: Some operculate Discomycetes from the park in Ilidža near Sarajevo (Jugoslávia). Čes.Mykol.25:197-202.
Nemlich,H.et Z.Avizohar-Hershenzon, 1975: Pezizales of Israel. III. Humariaceae (A). Israel Journ.Bot.24:19-197.
Pfister,D.H., 1985: North American Pezizales: Greletia and Marcelleina. Sydowia, Ann.Mycol. Ser.II. 38:235-240.
Rifai,M.A.,1968: The Australasian Pezizales in the Herbarium of the Royal Botanic Gardens Kew. Verhand.Konink.nederl.Akad.Wetensch.ser. natur.,Amsterdam 57/3:1-295.
Quélet.L., 1886: Quelques espèces critiques ou nouvelles de la flore mycologique de France. Ass.fr.avanc.Sci.Grenoble, 14 (2).
Schumacher,T.,1979: Notes on taxonomy,ecology amd distribution of operculate discomycetes (Pezizales) from river banks in Norway. Botany 1:53-83.
Svrček,M.,1958: Nové druhy diskomycetů z Belanských Tater. Čes.Mykol. 12:219-231.
Svrček,M.,1981: Katalog operkulátních diskomycetů (Pezizales) Československa II., Čes.Mykol. 35 (2):64-89.
Svrček,M.et Kubička J.,1961: Operkulátni diskomycety od rybníka Dvořiště v jižních Čechách. Čes.Mykol. 21:146-150.
Vacek,V.,1949: Novae fungorum species et varietates. Stud.Bot.Cechoslov. 10:129-135.
Velenovský,J.,1934: Monographia Discomycetum Bohemiae. Pragae.
Zhuang,W.et R.P.Korf,1986: A monograph of the genus Aleurina Massee (=Jafneadelphus Rifai). Mycotaxon 26:361-400.

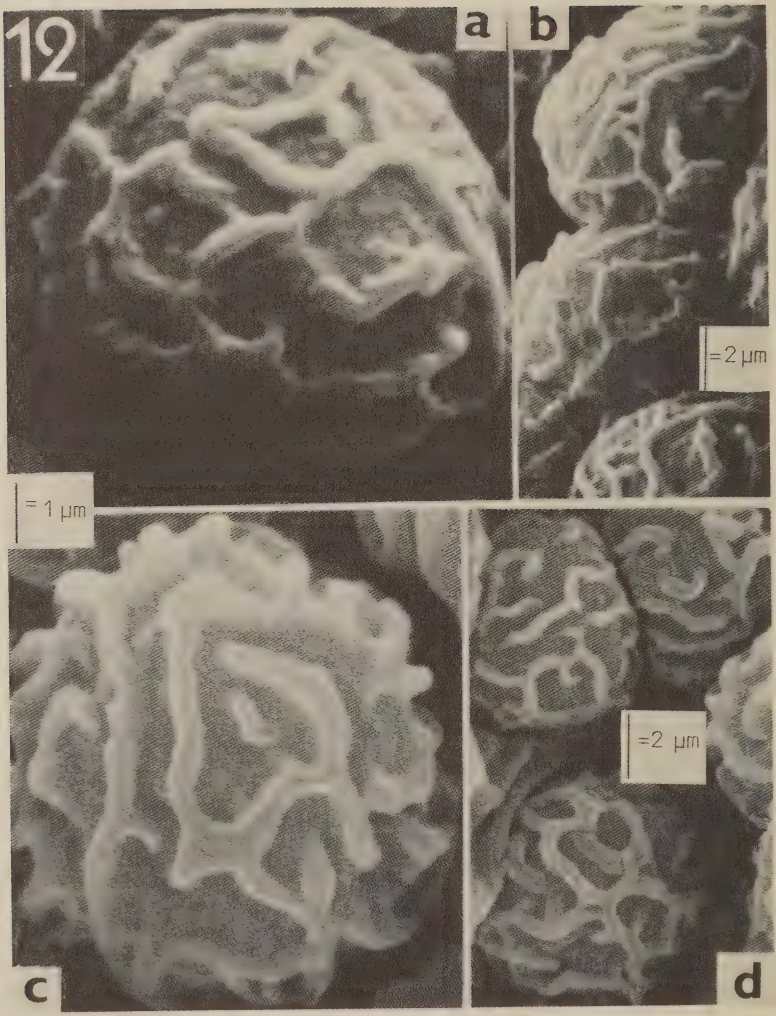

12
a
b
c
d
= 1 µm
=2 µm
=2 µm

Fig. 12: SEM of ascospores of Marcelleina persoonii.
a,b. Norway, Torp, (Krist.,J.Mor.).
c,d. Norway, Gjömle, (Krist.,J.Mor).

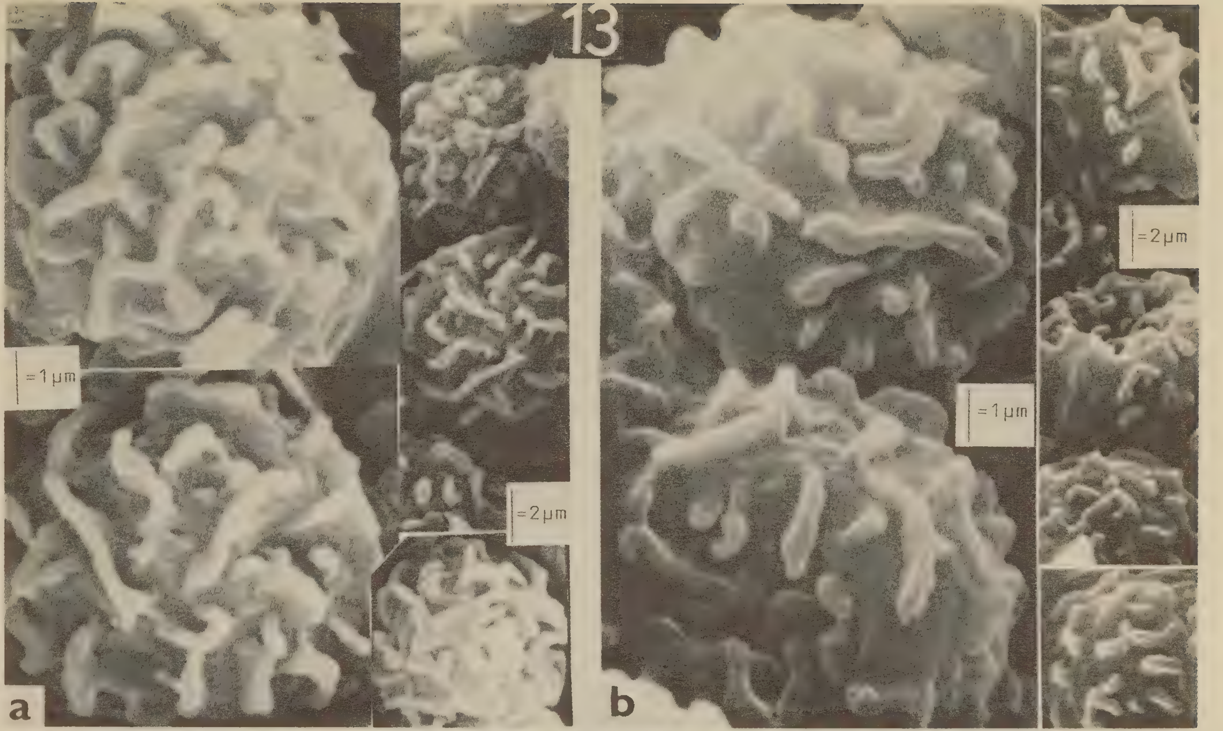

13
a
b
=1 µm
=2 µm
=1 µm
=2 µm

Fig. 13: SEM of ascospores of *Marcelleina rickii*. a. Type of *Detonia rickii*, (S) ; b. Czechoslovakia, Slovakia, Mt. Belanské Tatry, Ždiar, (J.Mor.).

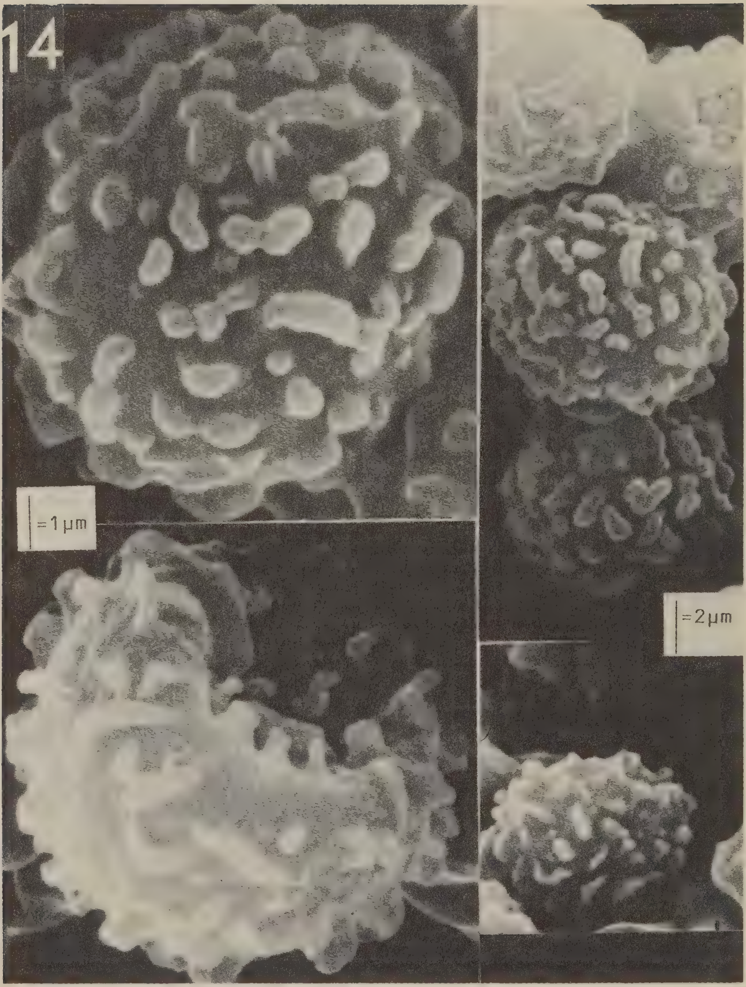


Fig. 14: SEM of ascospores of Marcelleina georgii. (Neotype (BRA).

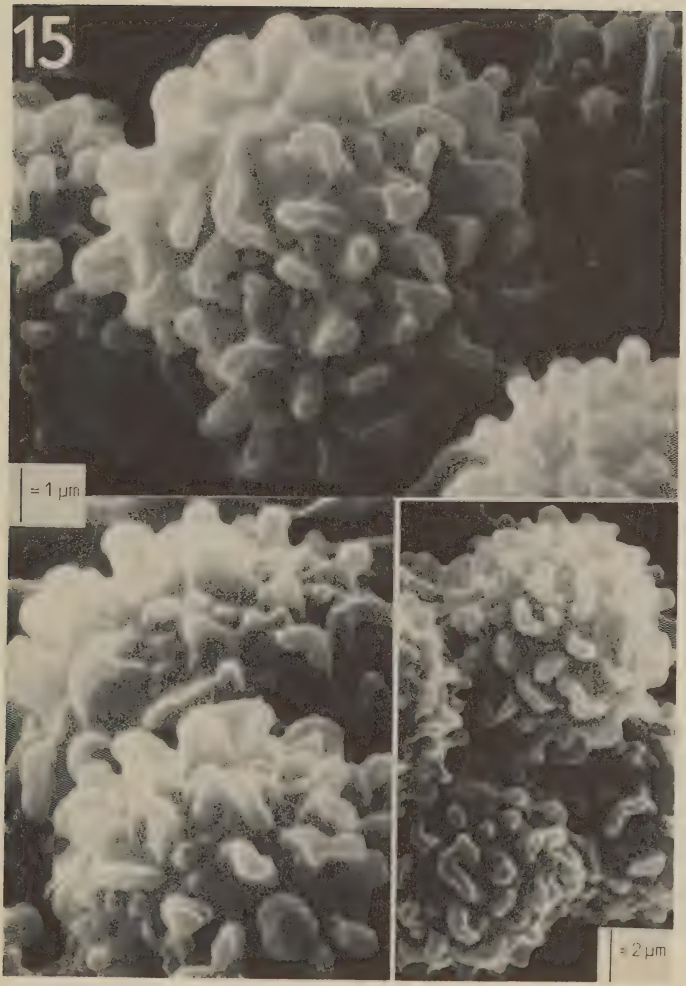
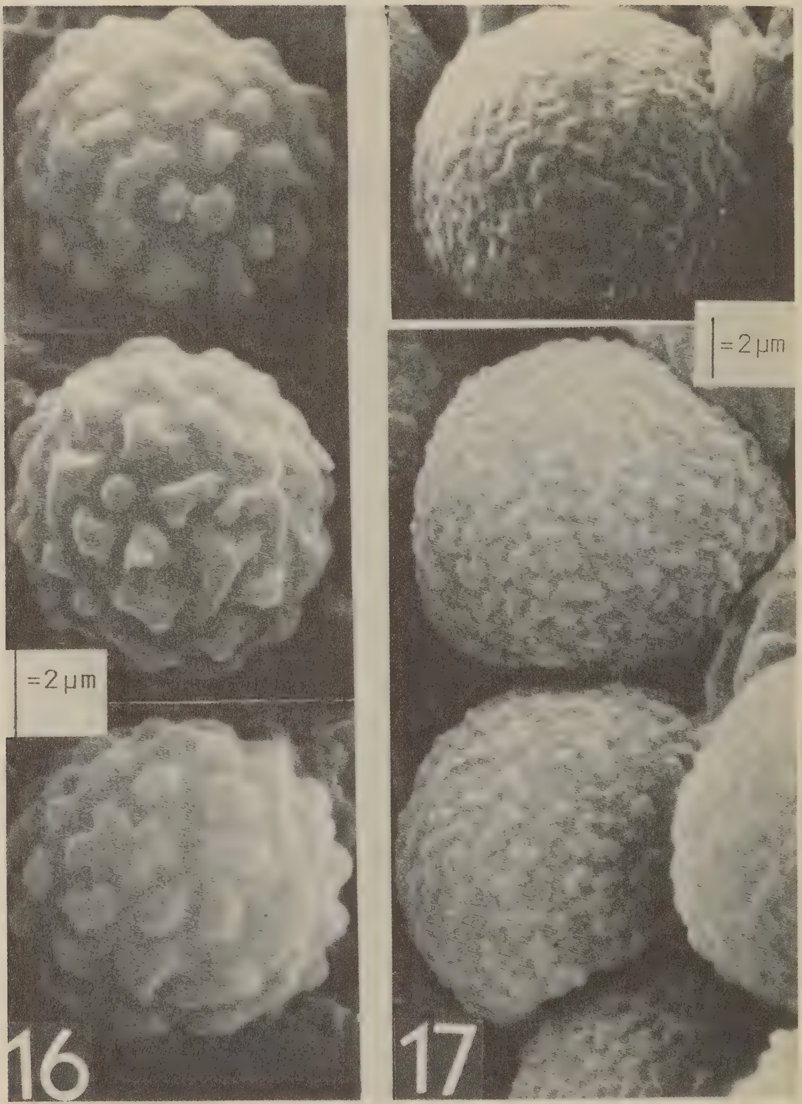


Fig. 15: SEM of ascospores of Marcelleina brevicostatispora. (Isotype BRA).


=2 µm
=2 µm
16
17

Figs. 16-17: SEM of ascospores of Marcelleina.
16: M. pseudoanthracina, GDR,(BHU).
17: M. donadinii (Isotype BRA).

18

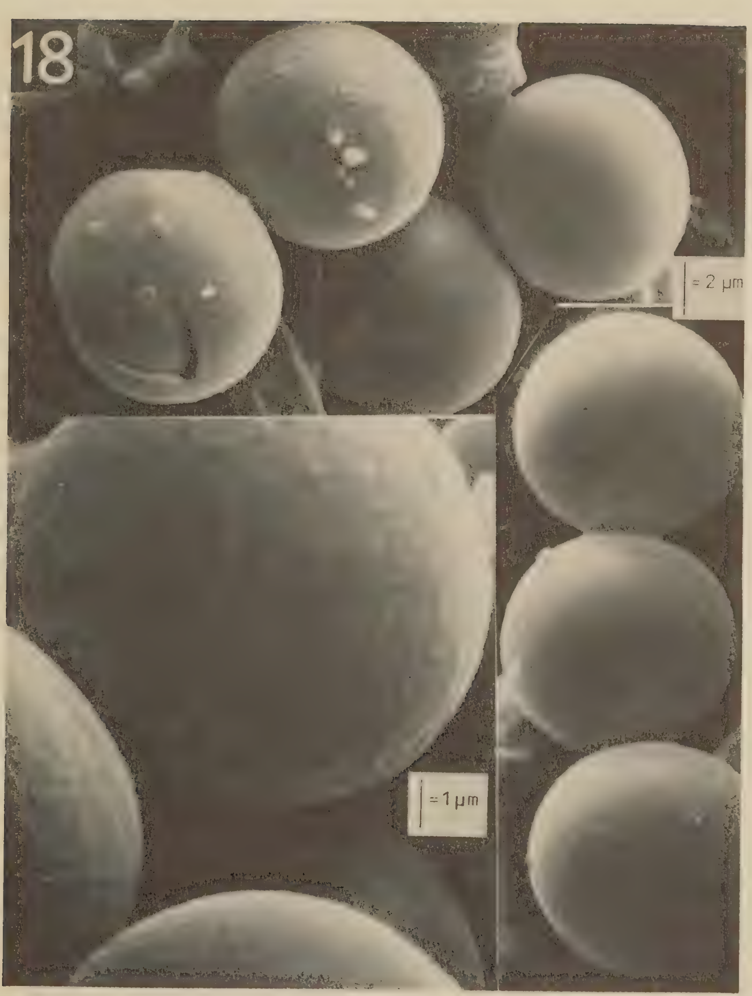


Fig. 18: SEM of ascospores of Marcelleina benkertii.
(Holotype BRA).

MYCOTAXON

Vol. XXX, pp. 501-507 October-December 1987

LEPTOGRAPHIUM WAGENERI VAR. PSEUDOTSUGAE, VAR. NOV., CAUSE OF BLACK STAIN ROOT DISEASE ON DOUGLAS-FIR

T. C. HARRINGTON

Department of Botany and Plant Pathology
University of New Hampshire
Durham, NH 03824

and

F. W. COBB, Jr.

Department of Plant Pathology
University of California
Berkeley, CA 94720

SUMMARY

Characteristics of the three host-specialized varieties of Leptographium wageneri are summarized. The variety on Douglas-fir (var. pseudotsugae) is described as new, and a new combination (L. wageneri var. ponderosum) is proposed for the variety on hard pines. The pinyon pathogen remains var. wageneri.

Leptographium wageneri (Kendr.) Wingf. (syn. Verticicladiella wageneri Kendr.), the cause of black stain root disease on conifers, was described from an isolate on singleleaf pinyon (Pinus monophylla Torr. & Frem.) (5). Three morphological variants of the fungus were later shown to be host-specialized to pinyons, hard pines and Douglas-fir, respectively (3,4). The variant on hard pines was shown to be morphologically and physiologically distinct from the pinyon variant and was described as V. wageneri var. ponderosa Harrington & Cobb (4). However, the data were then insufficient to designate the Douglas-fir variant at a formal taxonomic level.

Table 1. Summary of characters delimiting the three varieties of Leptographium wageneri. Forty-five isolates (15 of each variety) were used to establish the range of characteristics. A listing of the isolates examined and details of character determinations can be found in Harrington and Cobb (4).

Character	var. wageneri	var. pseudotsugae	var. ponderosum
mycelial pigment on PDA[a]	yellowish-olive to hellebore green	yellowish-olive to hellebore green	sudan brown to dresden brown
mycelial margin on PDA[a]	0-3 mm hyaline margin	2-7 mm hyaline margin	pigmented margin
colony diameter at 25 C[b]	5-50 mm	5-50 mm	0-10 mm
Conidiophore production on water agar[c]	moderate to abundant	moderate to abundant	sparse to none
swelling of conidiophore stipe apex[d]	0-2 µm	2-6 µm	0-2 µm
primary hosts	Pinus monophylla Pinus edulis	Pseudotsuga menziesii	Pinus ponderosa Pinus jeffreyi Pinus contorta

[a] After 7 days growth on potato dextrose agar at 18 C. Colors are from Ridgway (7).

[b] After 10 days growth on PDA.

[c] On colonized PDA plugs transferred to water agar and incubated for 10 days at 18C.

[d] Width of stipe apex minus the width of the middle of the uppermost stipe cell. Range of means of 15 isolates, five conidiophores measured per isolate.

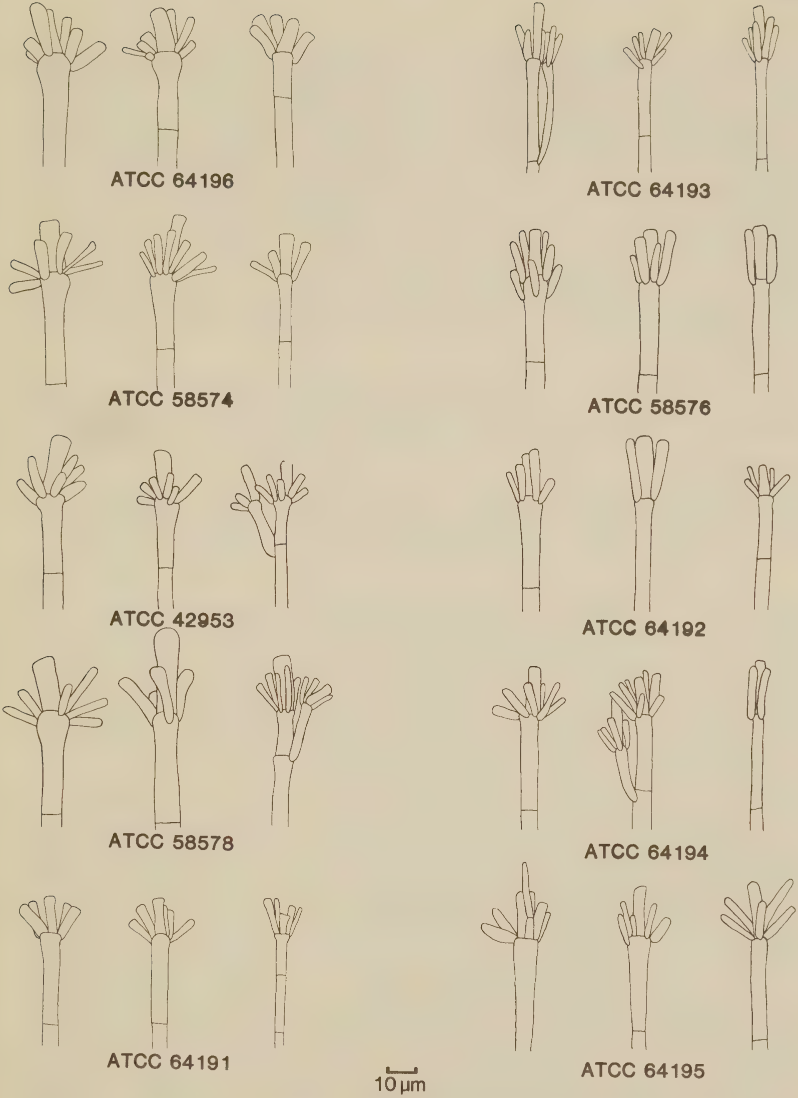

ATCC 64196
ATCC 64193
ATCC 58574
ATCC 58576
ATCC 42953
ATCC 64192
ATCC 58578
ATCC 64194
ATCC 64191
10 µm
ATCC 64195

Figure 1. Conidiophore stipe apices and primary metulae of five isolates of *Leptographium wageneri* var. *pseudotsugae* (left column) and five isolates of *L. wageneri* var. *wageneri* (right column) produced on colonized malt agar plugs transferred to water agar. For each isolate, the size range in the swelling of the stipe apex (from greatest to smallest, left to right) is seen in three conidiophores.

The Douglas-fir variant differed from the variant on pinyons (var. *wageneri*) by having a wider, hyaline advancing mycelial margin on potato dextrose agar (PDA) and a larger swelling at the apex of the conidiophore stipe (Table 1, Fig. 1). However, there was slight overlap among isolates of the two groups in these two characters (4). Based on isolation data, the Douglas-fir variant had a distinct host range, but inoculations of seedlings of Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco) and ponderosa pine (*Pinus ponderosa* Laws.) did not clearly differentiate the host ranges of the Douglas-fir and pinyon variants (3).

Subsequently, a similar cross-inoculation study that included seedlings of pinyon showed all three groups to be specialized to their respective hosts (1). Isolates from pinyons infected and killed 44% of the inoculated pinyon seedlings, whereas isolates from Douglas-fir and hard pines killed 3% and 13%, respectively, of the pinyon seedlings.

In addition, two isozyme studies have shown that the three variants have unique enzyme phenotypes (6,9). Both studies found little variation in isozyme phenotype within the species, and most of this variation was among, rather than within, the three variants. These isozyme studies and the cross-inoculation study discussed above, in addition to the previously noted morphological differences, support varietal status for the Douglas-fir variant.

Wingfield (8) has argued that *Leptographium* and *Verticicladiella* should be synonymized because the sole character separating the genera is the mode of proliferation of conidiogenous cells (annellidic and sympodial, respectively). We have found only sympodial proliferation in *L. wageneri*, but this character has been found to be variable in other species in this group and in other genera of fungi. *Leptographium* has priority over *Verticicladiella*, and Wingfield (8) has proposed the combination *L. wageneri*. The new combination for var. *ponderosa* is proposed herein. We, likewise, place the new variety in *Leptographium*.

Leptographium wageneri (Kendr.) Wingf. var. ***wageneri***, Trans. Brit. Mycol. Soc. 85:92, 1985.

Verticicladiella wageneri Kendr. var. *wageneri*, Can. J. Bot. 40:793, 1962.

Leptographium wageneri var. **ponderosum** (Harrington & Cobb) Harrington & Cobb, comb. nov.
Verticicladiella wageneri var. ponderosa Harrington & Cobb, Mycologia 78:568, 1986.
Teleomorph: **Ophiostoma wageneri** (Goheen & Cobb) Harrington, Mycotaxon 28:42, 1987.
Ceratocystis wageneri Goheen & Cobb, Phytopathology 68:1193, 1978.

Leptographium wageneri var. **pseudotsugae** Harrington & Cobb, var. nov.

A varietae wageneri differt colonia margine hyalino 2-7 mm lato in PDA culturo post 7 dies in 18 C. Tumor in apice stipitis conidiophori 2-6 um latior quam medius cellulae superioris stipitis.

Typus isolatus ex Pseudotsuga menziesii a T. C. Harrington, Union Valley Reservoir, El Dorado County, California, July 1980. Preservatus in UCB 1475052.

Colonies as in var. wageneri except the hyaline advancing margin 2-7 mm wide after 7 days growth on PDA at 18 C (compared to 0-3 mm wide in var. wageneri). Swelling at the apex of conidiophore stipes 2-6 um wider than the middle of the uppermost cell of the stipe. Otherwise, conidiophores and conidia (Fig. 2) as in var. wageneri.

Strains examined: Pseudotsuga menziesii: CANADA: British Columbia; Cicero, isolated by R. S. Hunt, 1980, **ATCC 58574** (=BCD-1). UNITED STATES: California; Sugar Pine Creek, El Dorado Natl. For., 1980, **CAD-7**; Union Valley Res., 1980, **ATCC 64196** (=CAD-18); Trinidad, 1980, **CAD-21**. Colorado; Evergreen, 1981, **ATCC 64191** (=COD-2). Idaho; Clearwater Natl. For., 1981, **IDD-1**; Priest River, by R. L. James, 1980, **IDD-2**. Montana; Flathead Indian Reservation, by J. W. Byler, 1980, **ATCC 58578** (=MOD-1); Lolo Pass, by R. L. James, 1981, **MOD-22**. Oregon; Westfir, 1980, **ORD-2**; Sandy, by D. J. Goheen, 1980, **ORD-4**. New Mexico; Mescalero, 1980, **NMD-1**. Washington; Quilcene, by D. J. Goheen, 1978, **WAD-U**. From Tsuga heterophylla: CANADA: British Columbia; Tugwell, by R. S. Hunt, 1979, **ATCC 42953** (=BCH-1). All strains isolated by the authors unless otherwise noted.

Holotype specimen: UCB 1475052, a dried culture of ATCC 64196.

The new variety is found throughout the western United States and in southern British Columbia, Canada (4). Aside from an isolate (ATCC 42953) from Tsuga heterophylla (Raf.) Sarg., Pseudotsuga menziesii is the only known host. In contrast, L. wageneri var. wageneri is known only from the southwestern United States, on Pinus monophylla and P. edulis Engelm. (4).

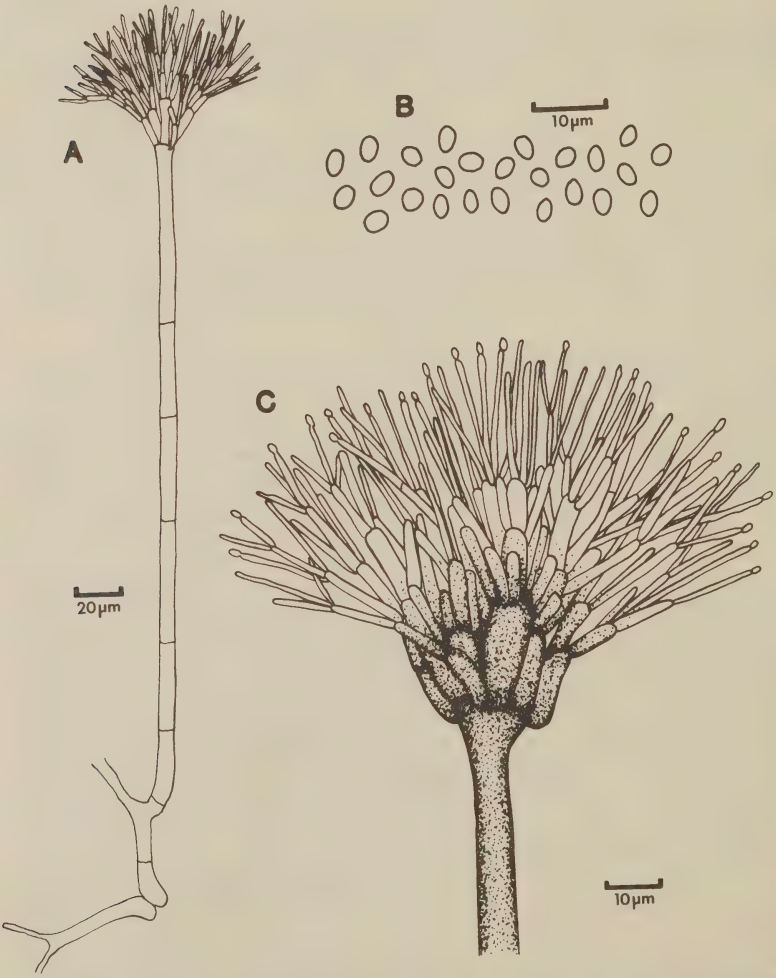


Figure 2. Conidiophores and conidia of Leptographium wageneri var. pseudotsugae isolate ATCC 64196 produced on pine twig medium (sections of twigs of Pinus resinosa Ait. in water agar). A. Entire conidiophore. B. Conidia. C. Conidiogenous apparatus.

No teleomorph of var. pseudotsugae or var. wageneri is known, but Ophiostoma wageneri has been reported from roots of Pinus ponderosa and is presumably the teleomorph of L. wageneri var. ponderosum (2,4).

ACKNOWLEDGEMENTS

Scientific Contribution Number 1514 from the New Hampshire Agricultural Experiment Station. J. W. Byler, D. J. Goheen, R. S. Hunt, and R. L. James kindly supplied some of the isolates. Helpful reviews of the manuscript by D. A. Glawe, J. D. Rogers, and P. J. Zambino are greatly appreciated. Angela Shipman prepared the Latin diagnosis, and Anne Stancioff prepared the figures.

LITERATURE CITED

1. Cobb, F. W., Jr., T. T. Lawson, and T. L. Popenuck. 1987. Interactions among the three variants of Verticicladiella wageneri and the three host types. Phytopathology 77: (in press). (Abstr.).
2. Goheen, D. J., and F. W. Cobb, Jr. 1978. Occurrence of Verticicladiella wagenerii and its perfect state, Ceratocystis wageneri sp. nov., in insect galleries. Phytopathology 68:1192-1195.
3. Harrington, T. C., and F. W. Cobb, Jr. 1984. Host specialization of three morphological variants of Verticicladiella wageneri. Phytopathology 74:286-290.
4. Harrington, T. C., and F. W. Cobb, Jr. 1986. Varieties of Verticicladiella wageneri. Mycologia 78:562-567.
5. Kendrick, W. B. 1962. The Leptographium complex. Verticicladiella Hughes. Can. J. Bot. 40:771-797.
6. Otrosina, W. J., and F. W. Cobb, Jr. 1987. Analysis of allozymes of three distinct variants of Verticicladiella wageneri isolated from conifers in western North America. Phytopathology 77: (in press).
7. Ridgway, R. 1912. Color standards and color nomenclature. Published by the author, Washington, D. C. 43 pp. + 51 pl.
8. Wingfield, M. J. 1985. Reclassification of Verticicladiella based on conidial development. Trans. Br. Mycol. Soc. 85:81-93.
9. Zambino, P. J., T. C. Harrington, and D. O'Malley. 1987. Isozyme analysis of three variants of the conifer root pathogen Verticicladiella wageneri. Phytopathology 77:124. (Abstr.).

MYCOTAXON

Vol. XXX, pp. 509-512 October-December 1987

NOTICE

INTERNATIONAL MYCOLOGICAL ASSOCIATION

REPORT OF BUSINESS MEETING HELD DURING THE XIV INTERNATIONAL BOTANICAL CONGRESS
BERLIN 25 JULY 1987

Contents

A. Preamble
B. Participants
C. Executive Committee Report
D. Treasurer's Report
E. Committee for the Development of Mycology in Asian Countries
F. Committee for the Development of Mycology in African Countries
G. Committee for the Development of Mycology in Latin-American Countries
H. Newsletter
I. International Mycological Directory
J. Fourth International Mycological Congress
K. Fifth International Mycological Congress
L. Relationship with IUMS
M. IMA officers after 1990
N. Acknowledgements

A. Preamble

1. This Notice provides a record of the Business Meeting of the International Mycological Association (IMA) held on Saturday 25 July 1987 during the XIV International Botanical Congress (IBC) in Berlin.

2. A record of the previous Business Meeting and General Assembly convened during the Third International Mycological Congress (IMC III) in Tokyo on 28 August-3 September 1983 was published in Mycotaxon 20(1): 153-162 (1984).

B. Participants

3. Professor J. Webster (President, UK), Professor Dr K. Esser (Vice-President, FRG Germany), Professor D.L. Hawksworth (Secretary-General, UK), Dr H.A. van der Aa (Treasurer, Netherlands), Professor Dr A. Bresinsky (FRG Germany), Dr V. Demoulin (Belgium), Dr. L. Holm (Sweden), Dr S.C. Jong (USA), Professor M.A. Peerally (Mauritius), Dr R.A. Shoemaker (Canada) and Dr C.J. Rabie (South Africa). Apologies were received from Dr G.C. Ainsworth (Honorary President, UK), Dr C.P. Kurtzman (USA), Dr Tu Chin-Chyu (Taiwan) and Dr E.G. Simmons (Vice-President, USA)and Dr T. Yokoyama (Japan).

C. Executive Committee Report

4. The Business Meeting considered the record of the meeting of the Executive Committee held on 8 September 1986 during the XIV International Congress of Microbiology in Manchester, UK. Matters arising from this meeting are incorporated into the body of the present record below.

D. Treasurer's Report

5. The Treasurer tabled audited accounts for the year ending 31 December 1986 which showed a balance of Hfl 35 931 at that date. He explained that some affiliated organizations were finding it difficult to pay the amounts due under the Statutes as agreed during IMC III in 1983. Proposals for more appropriate financial regulations needed developing and he undertook to prepare draft suggestions for discussion by the Executive Committee and affiliated organizations for discussion prior to IMC IV, where any change in the Statutes necessary could be effected. The President paid tribute to the Treasurer for his efforts in improving the financial standing of the IMA during the last three years.

E. Committee for the Development of Mycology in Asian Countries

6. The Secretary-General reported that the Committee had held a most successful second meeting on 13-15 March 1986 in the Genting Highlands, Malaysia. The meeting was chaired by Professor K. Tubaki (Chairman, Japan) and attended by invited delegates from eight Asian countries. A short report of the meeting appeared in the Mycological Society of Japan News 1985: 18-20 (1986) and the texts of the 16 papers presented were published in Transactions of the Mycological Society of Japan 28: 75-104 (1987).

7. The Committee agreed to organize a workshop prior to the International Congress of Plant Pathology meeting in Kyoto, Japan (i.e. prior to 20 August 1988) on aspects of teaching and training in mycology in Asian countries. Details will be circulated to representatives of Asian countries as soon as they become available.

F. Committee for the Development of Mycology in African Countries

8. Professor Peerally (Chairman, Mauritius), who had kindly agreed to establish this Committee at the request of the IMA Executive Committee, reported that he was planning to establish a committee of 8-10 members and had contacted mycologists in Egypt, Kenya, Mauritius, Nigeria, Senegal, Tanzania, Uganda and Zimbabwe. It was hoped to convene a first meeting in either Nairobi or Reduit in the latter half of 1988 and enquiries were being made to funding bodies for possible support of the costs of delegates participating in this meeting.

G. Committee for the Development of Mycology in Latin-American Countries

9. The Secretary-General regretted that no report on the activities of this Committee had been received.

H. Newsletter

10. The Secretary-General reported that, in accordance with discussions held at the 1986 IMA Executive Committee, IMA News no. 1 (July 1987) had been published. Ten thousand copies had been printed and were being sent to those affiliated organizations who had agreed to distribute them to their members and were being made available at relevant international meetings and to other appropriate bodies. It was planned to issue IMA News irregularly as required at least until 1990 subject to available resources.

I. International Mycological Directory

11. In view of the success of the International Mycological Directory published on the occasion of the First International Mycological Congress in 1971, it was agreed that the IMA should prepare a second edition of this reference work for publication in 1988/89. It was felt that this should be similar in size to the 1971 edition and include information on mycological societies, journals, culture collections, and herbaria. The Treasurer of the IMA was authorized to utilize IMA funds for the compilation of this work which would be offered to the CAB International Mycological Institute for publication.

J. Fourth International Mycological Congress (IMC IV)

12. Professor Dr Bresinsky reported on arrangements being made for IMC IV to be held in Regensburg from 28 August-3 September 1990. A preliminary announcement appeared in IMA News no. 1 (July 1987) and it was planned to issue a first circular early in 1988. The Organizing Committee for IMC IV would meet in Berlin on 30 July and in Regensburg on 23 October 1987.

13. Arrangements for the free use of the facilities of the University of Regensburg had been made and it was planned to keep registrations modest with reduced fees for students. The fees should, however, include contributions to IMA funds to facilitate its work and the planning of IMC V.

14. The Secretary-General agreed to invite all organizations affiliated to the IMA to propose topics for symposia for consideration by the Organizing Committee.

15. The offer of inputs from the International Union of Microbiological Societies (IUMS) Mycology Division was gratefully received and it was agreed that the Secretary-General approach the Division on behalf of the Organizing Committee.

16. It is planned to hold field excursions in various parts of Europe immediately prior to the Congress.

K. Fifth International Mycological Congress (IMC V)

17. The President invited members of the Executive Committee and affiliated organizations to start to consider possible venues for the Fifth International Mycological Congress. It was considered desirable to encourage invitations from affiliated organizations and groups of mycologists as appropriate in continents where no IMC had previously been held.

18. It was generally agreed that the interval between IMC III and IMC IV had been longer than desirable and that shorter intervals should be aimed at in future. Intervals of 3 or 4 years were felt to be more appropriate with particular attention being paid to the avoidance of future clashes with IUMS Mycology Division congresses.

L. Relationships with IUMS

19. The President reported on discussions held between representatives of the International Union of Microbiological Societies (IUMS) Mycology Division and the IMA held in London on 20 May and 23 October 1986. These meetings were arranged with the assistance of the British Mycological Society and the Royal Society of London whose assistance was gratefully acknowledged.

20. A working party to investigate the interrelationships between the two organizations in depth has been established at the October 1986 meeting under the chairmanship of Professor L.R. Batra (USA). It was hoped that a report would be available for consideration by affiliated organizations in time to permit any modifications to IMA Statutes required to be effected at IMC IV.

21. The principles which the IMA representatives on the working party (the President and Secretary-General) should bear in mind in the negotiations were considered and endorsed by the meeting.

M. IMA Officers after 1990

22. The President drew attention to the fact that IMA officers to serve from 1990 to IMC V would need to be elected at IMC IV. The Secretary-General would then have served 13 years in this position and wished to resign, but it was hoped that the Treasurer could continue for a second term. Members of the Executive Committee and affiliated organizations were invited to consider possible nominations.

N. Acknowledgements

23. The President thanked Professor Dr K. Esser (President, XIV IBC) and the Organizing Committee of the XIV IBC for providing facilities for the meeting.

D.L. Hawksworth
Secretary-General, IMA
CAB International Mycological
Institute
Ferry Lane, Kew, Surrey TW9
3AF, UK

1 August 1987

MYCOTAXON

Vol. XXX, p. 513 October-December 1987

NOTICE

X CONGRESS OF THE INTERNATIONAL SOCIETY FOR HUMAN AND ANIMAL MYCOLOGY

The Second Announcement of the Congress, to be held June 27th through July 1, 1988 in Barcelona, has been mailed. Two conferences, three symposia, 22 round tables, plus free papers, oral communications, and posters are scheduled. A post-congress workshop on July 2, and optional tours for accompanying persons as well as post-congress trips are also announced. ISHAM members receive a discount on the registration fee. For further information please contact:

V. Iberia Congresos
Trafalgar, 2
08010 Barcelona
Spain

AUTHOR INDEX, VOLUME THIRTY

ADLER, MÓNICA T., *see* ELIX & ADLER
ADLER, MÓNICA T. & JOHN A. ELIX, Three new saxicolous species in Parmeliaceae (lichenized Ascomycotina) from Argentina 339-344
ANON., Notice: International Mycological Association report of business meeting held during the XIV International Botanical Congress, Berlin, 25 July 1987 509-512
ANON., Notice: X Congress of the International Society for Human and Animal Mycology 513
ARAMBARRI, ANGÉLICA, MARTA CABELLO, AND ADRIANA MENGASCINI, New hyphomycetes from Santiago River. II. (Buenos Aires Province, Argentina) 263-267
ARNOLDS, EEF, *see* TERMORSHUIZEN & ARNOLDS
BAGYANARAYANA, G., P. RAMACHAR, & K. NIRANJAN RAO, A new species of *Uromyces* on *Atylosia* from India 193-194
BANDALA-MUÑOZ, VICTOR M., *see* GUZMÁN & AL.
BERNICCHIA, ANNAROSA, *see* HALLENBERG & BERNICCIA
BURCH, KATHERINE B., *see* MORGAN-JONES & BURCH
CABELLO, MARTA, *see* ARAMBARRI & AL.
CAO, JIN-ZHONG, *see* LIU & AL.
CARRIS, L. M.,*Vaccinium* fungi: *Corynespora arctespora,* comb. nov. 127-132
CASTILLO T., JOSÉ, *see* GUEVERRA & AL.
COBB, F. W., JR., *see* HARRINGTON & COBB
DESCALS, ENRIQUE, *see* REGELSBERGER & AL.
EICKER, ALBERT, *see* MORGAN-JONES & AL.
EICKER, ALBERT, *see* SINCLAIR & AL.
ELIX, JOHN A., *see* ADLER & ELIX
ELIX, JOHN A. & MÓNICA T. ADLER, A new species of *Flavoparmelia* and *Flavopunctelia* (lichenized Ascomycotina) from Argentina 335-338
FARR, M. L., A new species of *Comatricha* from Colorado 455-458
FERREIRA, F. A. & J. J. MUCHOVEJ, *Asteromidium tabebuiae* sp. nov. from Brazil 97-100
FIGUERAS, M. J., *see* VALLDOSERA & AL.
GARCÍA J., JÉSUS, *see* GUEVERRA & AL.
GINNS, J., *see* REDHEAD & AL.
GUARRO, J., *see* VALLDOSERA & AL.
GUEVERRA G., GONZALO, JESUS GARCÍA J., JOSE CASTILLO T., & ORSON K. MILLER, JR., New records of *Lactarius* in Mexico 157-176
GUSTAVSSON, ARNE, *Peronospora* on two *Cerastium* species in northern Europe 133-148
GUZMÁN, GASTÓN, VICTOR M. BANDALA-MUÑOZ, & LETICIA MONTOYA-BELLO, The known species of *Phaeocollybia* (Agaricales, Cortinariaceae) in Mexico 221-238
HALE, MASON E., New or interesting species of *Xanthoparmelia* (Vanio) Hale (Ascomycotina: Parmeliaceae) 319-334
HALLENBERG, NILS & ANNAROSA BERNICCHIA, Cultural studies in *Fibricium* (Corticiaceae, Basidiomycetes) 203-208
HANLIN, RICHARD T. & OMAR TORTOLERO, A new species and a new combination in *Cercophora* 407-416
HANSEN, ERIC STEEN & JOSEF POELT, New or interesting Greenland lichens IV 69-80
HARRINGTON, T. C. & F. W. COBB, JR., *Leptographium wageneri* var. *pseudotsugae,* var. nov., cause of black stain root disease on Douglas-fir 501-507
HILBER, OSWALD, RUZENA HILBER, & ORSON K. MILLER, JR., Fungi of the Appalachian Mountains 269-288
HILBER, RUZENA, *see* HILBER & AL.
HUHTINEN, SEPPO, Taxonomic studies in the genera *Protounguicularia, Arachnopeziza* and *Dematioscypha* 9-28
ING, B., Corticolous myxomycetes from Cyprus 195
ING, B., J. SIWASIN, & S. SAMARNPAN, Myxomycetes from Thailand – II 197
ING, BRUCE, Myxomycetes from Hong Kong and southern China 199-201

KORF, RICHARD P., *see* ZHUANG & KORF
KOSKE, R. E., *see* WALKER & KOSKE
KUTHUBUTHEEN, A. J., *see* NAWAWI & KUTHUBUTHEEN
LÆSSØE, THOMAS, *Xylaria corniformis* reconsidered 81-85
LINDSEY, J. PAGE, A new species of *Aleurodiscus* from Colorado 433-437
LIU, BO, JIN-ZHONG CAO, AND MEI-HUA LIU, Two new species of the genus*Wynnea* from China with a key to known species 465-471
LIU, MEI-HUA, *see* LIU & AL.
LUSK, DEMARIS E., *Pseudaleuria quinaultiana,* a new genus and species of operculate ascomycete from the Olympic Peninsula 417-431
MCGINNIS, MICHAEL R., *see* SIMMONS & AL.
MENGASCINI, ADRIANA, *see* ARAMBARRI & AL.
MESSNER, KURT, *see* REGELSBERGER & AL.
MILLER, ORSON K., JR., *see* GUEVERRA & AL.
MILLER, ORSON K., JR., *see* HILBER & AL.
MONTEMARTINI CORTE, A., *Massariella:* a debated genus 289-299
MONTOYA-BELLO, LETICIA, *see* GUZMÁN & AL.
MORAVEC, JIŘÍ, A taxonomic revision of the genus *Marcelleina* 473-499
MORGAN-JONES, GARETH, Notes on hyphomycetes. LIV. Concerning *Pithomyces clavisporus,* a new species, *P. graminicola* and *P. pavgii* 29-37
MORGAN-JONES, GARETH, *see* SINCLAIR & AL.
MORGAN-JONES, GARETH, *see* WHITE & MORGAN-JONES
MORGAN-JONES, GARETH & KATHERINE B. BURCH, Studies in the genus *Phoma.* IX. Concerning *Phoma jolyana* 239-246
MORGAN-JONES, GARETH & J. F. WHITE, JR., Notes on coelomycetes. II. Concerning the *Fusicoccum* anamorph of *Botryosphaeria ribis* 117-125
MORGAN-JONES, GARETH & J. F. WHITE, JR., Notes on coelomycetes. III. Concerning *Microsphaeropsis concentrica:* morphology and ultrastructure 177-187
MORGAN-JONES, GARETH, ROBERT C. SINCLAIR, & ALBERT EICKER, Notes on hyphomycetes. LV. *Craneomyces* gen. nov. and *Trichobotrys effusa* 345-350
MUCHOVEJ, J. J., *see* FERREIRA & MUCHOVEJ
NAWAWI, A. & A. J. KUTHUBUTHEEN, A new species of the genus *Subulispora* 459-463
POELT, JOSEF, *see* HANSEN & POELT
QUADRACCIA, LIVIO, Recherches sur *Hebeloma* (Agaricales, Cortinariaceae). I. Quelques notes taxonomiques et nomenclaturales 301-318
RAMACHAR, P., *see* BAGYANARAYANA & AL.
RAO, K. NIRANJAN, *see* BAGYANARAYANA & AL.
RAPPAZ, FRANÇOIS, Taxonomie et nomenclature de *Diatrype stigma, D. decorticata* et *D. undulata* (Diatrypaceae, Ascomycetes) 209-219
REDHEAD, S. A., J. GINNS, AND R. A. SHOEMAKER, The *Xerula (Collybia, Oudemansiella) radicata* complex in Canada 357-405
REGELSBERGER, BARBARA, KURT MESSNER, & ENRIQUE DESCALS, Species diversity of aquatic hyphomycetes in four Austrian streams 439-454
RINALDI, MICHAEL G., *see* SIMMONS & AL.
SAMARNPAN, S., *see* ING & AL.
SHOEMAKER, R. A., *see* REDHEAD & AL.
SIMMONS, EMORY G., MICHAEL R. MCGINNIS, & MICHAEL G. RINALDI, *Dissitimurus,* a new dematiaceous genus of hyphomycetes 247-252
SIMPSON, J. A. & C. STONE, A new species of *Thaxteriola* associated with mites in Australia 1-4
SINCLAIR, ROBERT C., *see* MORGAN-JONES & AL.
SINCLAIR, ROBERT C., ALBERT EICKER, AND GARETH MORGAN-JONES, Notes on hyphomycetes. LVI. *Ceratosporella cheiroidea,* a new species 351-355
SIWASIN, J., *see* ING & AL.
STONE, C., *see* SIMPSON & STONE
TAVARES, ISABELLE I., The taxa of *Usnea* (Lichenes) described by Michaux from eastern North America 39-68

TERMORSHUIZEN, AAD & EEF ARNOLDS, On the nomenclature of the European species of the *Armillaria mellea* group 101-116
TORTOLERO, OMAR, *see* HANLIN & TORTOLERO
VALLDOSERA, M., J. GUARRO, & M. J. FIGUERAS, Coprophilous fungi from Spain VII. *Faurelina hispanica* sp. nov. 5-7
WALKER, CHRISTOPHER & R. E. KOSKE, Taxonomic concepts in the Endogonaceae: IV. *Glomus fasciculatum* redescribed 253-262
WHITE, J. F., JR., *see* MORGAN-JONES & WHITE
WHITE, J. F., JR. & GARETH MORGAN-JONES, Endophyte-host associations in forage grasses. X. Cultural studies on some species of *Acremonium* sect. *Albo-lanosa,* including a new species, *A. starrii* 87-95
WINGFIELD, MICHAEL J., A new name for *Phialocephala illini* 149-156
ZHUANG, WEN-YING & RICHARD P. KORF, *Xeromedulla,* a new genus of foliicolous discomycetes (Leotiaceae) 189-192

INDEX TO FUNGOUS AND LICHEN TAXA, VOLUME THIRTY

This index includes the names of genera, infrageneric taxa, species, and infraspecific taxa. New names are in **boldface,** as are the page numbers on which such new taxa are proposed. New names of suprageneric taxa appear in **boldface CAPITALS.**

Acarospora
  scabra 72
  stapfiana 69, 70, 78
Acremonium 94
  sect. Albo-lanosa 87, 90, 94
    chisosum 88, 94
    coenophialum 87-94
    huerfanum 87, 88, 92-94
    loliae 92
    lolii 92, 94
    starrii 87, **88**, 90-94
    typhinum 87-94
Agaricus
  tribe Lepiota 105
    annularius 104, 106, 112
    annularius luteus 104
      var. A 104
      var. B 104
      var. C 104, 114
    caeruleo-viridis 105
    citri 106, 114
    congregatus 106, 112, 114
    cumulatus 106
    elasticus 106, 107, 113
    fastibilis 303, 304, 306
      (rank ?) β circinans 304
    fuscopallidus 107, 110, 112, 113
    laricinus 108
    melleus 104, 106, 108, 109, 111-114
      var. coryli 106, 114
      var. vitis 113
    millus 109
    obscurus 110-113
    occultans 111
    pistillaris 111
    polymices
      var. (unnamed) 110
    polymyces 110-112
      var. obscurus 110, 111
    putridus 112
    radicatus
      var. superbiens 383
    stipitis 113
      var. 1 113
      var. 2 113
      var. 3 113
      var. 4 113
      var. 5 113
      var. 6 113
    texensis 358, 360, 390
    truncatus 316
Alatospora
    acuminata 442
    flagellata 442
    pulchella 442
Aleuria 417, 424-426, 428
    aurantia 422, 427
Aleurina 474, 475
Aleurodiscus 433
    canadensis 435-437
    mesaverdensis 433-436
Alternaria 239, 252
Amphisphaeria 289-291
    bufonia 291, 292
    cavata 290
    conica 291
    fallax 291
    millepunctata 291
    umbrina 290
Anguillospora
    crassa 442, 450, 451
    furtiva 442, 452
    longissima 442, 450
    rosea 451
Anthracobia 424
Arachnopeziza 9, 10, 12-14, 16, 18
    aurelia 13
    cornuta 13
    delicatula 13
    eriobasis 13
    leonina 13
    monoseptata 16, **18**
    subnuda 13
    trabinelloides 13
    variepilosa 14, 15
Arcyria
    cinerea 197, 200
    denudata 197
Armillaria 101, 102, 104, 105, 108-112, 114
    borealis 101, 103, 104, 106-109, 112, 114
    bulbosa 101, 104, 107, 108, 111, 113, 115
    casimiri 105
    cepaestipes 105
    cepistipes 101, 103, 105, 107-109, 112-114
      f. pseudobulbosa 105, 112-114
    cerasi 105, 114

  granulosa 107
  inflata 107, 115
  lutea 101, 103, 105, 106, 108-110, 112, 115
  mellea 101, 102, 104-107, 109-111, 113-115
    var. bulbosa 104, 108, 115
    var. minor 109, 114
    var. obscura 110, 114
    var. viridiflava 113, 114
  montagnei 110, 115
  mucida 390
  obscura 101, 114
  ostoyae 101, 103, 106, 107, 110-112, 114
  praecox 112, 114
  saviczii 113
Armillariella 102, 112
  bulbosa 115
  mellea 114
  montagnei 107, 109, 115
  obscura 110, 114
  ostoyae 111, 114
  polymyces 114
Arthrorhaphis 70
  anziana 70
  citrinella 70
    var. citrinella 70
  vacillans 70, 78
Articulospora
  angulata 442, 445
  tetracladia 442
Ascobolus
  brassicae 484
  persoonii 477, 478
Ascodemis 474
Asteromidium 97
  imperspicuum 99
  secundum 99
  tabebuiae **97**, 99
Asteropsis 178
Atkinsonella
  hypoxylon 87

Bacidia
  anziana 70
Baeomyces 70
Balansia
  epichloë 87
Barlaea 475
  cookei 490
  persoonii 477, 479
  subcoerulea 473, 477, 478
Barlaeina 473, 475
  amethystina 484
  persoonii 477
Bombardia 415
  coprophila 411
Botryodiplodia 120
Botryosphaeria 118
  berengeriana 118
  corticis 130
  dothidea 118, 120
  mali 120, 124
  ribis 117, 118, 120, 122, 124
    f. achromogena 120
  ribis chromogena 120
Brachysporium 20

Caloplaca 73
  bracteata 70
  tominii 74
  trachyphylla 70
Camposporium
  pellucidum 442
Campylospora
  chaetocladia 442, 445
Canomaculina 339-341
  tandilensis **339**-342
  ventanica 339, **340**-342
Capnophialophora 128, 130
Catapyrenium
  lachneum 71, 73
Catathelasma 10
  imperiale 105
Ceratocystis
  wageneri 505
Ceratosporella 351
  bicornis 351
  cheiroidea 351, **352**, 354, 355
  deviata 351, 355
  goidanichii 351
  lambdaseptata 351
  novae-zelandiae 351, 355
  ponapensis 351, 355
  stipitata 351, 355
Cercophora 274, 407, 408, 411, 414, 415
  albicollis 414
  ambigua 274, 275
  appalachianensis **269**, 271, 273-275
  arenicola 274
  caudata 275
  coprophila 411
  costaricensis 275
  elephantina 414
  gossypina 415
  macrocarpa 275
  newfieldiana 275
  palmicola 407, **408**, 410-412, 414, 415
  scortea 414
  solaris 275
  sparsa 275

  - **subambigua** 407, 408, **411**-415
  - sulphurella 275
- Chadefaudiella 7
- Chaetopsina 150, 153
  - catenulata 150
  - fulva 150
  - **illini** 152, **153**
  - penicillata 150, 153, 154
  - polyblastia 150
  - splendida 150
- Cheiromyces
  - bulbophorus 263
  - inflatus 263
  - stellatus 263
  - **wrightii** **263**, 264
- Chrysonilia 7
- Clastoderma
  - debaryanum 195, 200
- Clavariopsis
  - aquatica 442
- Clavatospora
  - longibrachiata 442
- Clisosporium 177, 178
  - diplodiella 177
  - lignorum 178
- Clitocybe 382
  - megalospora 357, 358, 360, 374, 378, 381-383
  - mellea 114
- Collaria
  - arcyrionema 197
- Collybia 357, 382
  - longipes 390, 392
  - radicata 358, 372, 382, 383, 390, 392, 402
    - var. furfuracea 357, 358, 362, 370, 372
    - var. minor 374, 376, 383
    - var. pusilla 358, 360, 372, 374, 382, 383
  - radicata pusilla 371
  - rugosoceps 357, 358, 386, 389, 402
  - umbrina 358, 360, 374, 378, 381-383
- Comatricha 455, 458
  - alta 195
  - anomala 458
  - ellae 195
  - reticulata 458
  - reticulospora 458
  - **subalpina** **455**-458
- Coniella 177
  - diplodiella 177
  - fragariae 178
- Coniochaeta 274
- Coniothyrella 184
- Coniothyrina 184
  - agaves 184
- Coniothyriopsis 178
- Coniothyrium 177, 178, 184-186
  - agaves 184
  - castagnei 184
  - concentricum 180
    - var. agaves 184
  - dasylirii 184
  - fuckelii 177, 178, 184, 186
  - henriquesii 185
  - minitans 185, 186
  - olivaceum 178
  - palmarum 177, 178
  - sarcinellae 186
  - scirpi 184
  - yuccae 178
  - zeae 184
- Cookeina 426
- Corynespora 127, 128
  - acaciae 36
  - **arctespora** **127**, 128, 130
  - cambrensis 128
- **Craneomyces** **345**, 348, 350
  - **verrucosus** 345, **346**-348
- Cribraria
  - cancellata 197
  - microcarpa 197
  - violacea 200
- Crocicreas 192
- Crouania 475
- Cryptodiaporthe
  - aesculi 118
- Cryptophaeella 178
- Culicidospora
  - aquatica 442
  - gravida 442
- Cystoderma 104
  - cinnabarinum 107
  - terrei 107

- Dactylaria
  - sect. Mirandina 264
    - **isthmospora** **263**, 264
- Dactylella
  - aquatica 442
- Dactylosporina 403
- Dasyscypha
  - heimerlii 19, 24-26
- Dasyscyphella
  - crystallina 12
- Dematioscypha 9, 10, 19, 20, 26
  - dematiicola 19, 20, 23-26
  - **richonis** **9**, **20**, 24, 26
    - var. **olivacea** 21, **23**, 24
    - var. richonis 20, 22-24
- Dendrospora 449
  - erecta 442
  - fastuosa 443, 450

- fusca 443
- moniliformis 447
- nana 443
- tenella 443
- torulosa 443

Detonia
- rickii 473, 479, 481, 482, 495

Diaporthe
- aesculi 118

Diatrype 209, 212, 216
- **decorticata** 209, 214, **215**-218
- spilomea 209, 211, 213
- stigma 209-218
  - var. decorticata 215
  - var. exserta 216
  - var. quadricocca 217
  - var. rugosa 217
  - (rank ?) b. cinerea 212
- undulata 209, 213-217

Diderma
- chondrioderma 200
- effusum 200

Didymium
- difforme 200
- eximium 200
- iridis 200
- proximum 200
- squamulosum 197

Diplodina 118
- aesculi 118

Dissitimurus **247**, 248, 252
- **exedrus** **247**-251

Dothiorella 118, 120, 124
- aesculi 118
- pyrenophora 120
- ribis 120

Dothisphaeropsis 178, 185
- concentrica 180
- hellebori 178

Dwayaangam
- cornuta 443

Dwayabeeja 350

Echinostelium
- corynophorum 195
- minutum 195, 200

Endogone 258

Endophragmia
- alternata 351

Eoaleurina 475

Epichloë
- typhina 88

Eriopezia 12
- caesia 13, 19

Eutypa 212
- lata 212

Everniastrum 324

Faurelina 5, 7
- elongata 5, 7
- fimigenes 7
- **hispanica** **5**
- indica 5, 7

Fibricium 203, 207
- rude 203, 205-207
- subceracea 203-207

Fibrodontia 207
- gossypina 203, 207
- subceracea 203

Filobasidiella
- arachnophila 531
- depauperata 531

Flagellospora
- curvula 443, 450

Flammulina 360, 392
- fennae 360, 392
- velutipes 360, 390

Flavoparmelia 335
- baltimorensis 335, 337
- **glomelliferica** **335**-337

Flavopunctelia 335
- **lobulata** 335-**337**
- praesignis 337

Fulgensia
- bracteata 71, 72
  - subsp. bracteata 72
  - subsp. deformis 69-71, 78

Fusicoccum 117, 118, 120, 122
- aesculi 117, 118, 120, 124

Geniculospora
- inflata 443

Geopyxis 424

Glomus
- aggregatum 254, 260
- clarum 256
- deserticola 254, 260
- fasciculatum 253-256, 258, 260, 261
- feugianum 260
- hoi 254, 260
- intraradices 260
- invermaium 260
- mosseae 253
- occultum 260

Glypholecia
- scabra 69, 72, 78

Greletia 473-475, 483, 488
- marchica 474, 491
- muelleri 474
- ovalispora 474, 491
- planchonis 473, 474, 478, 488, 490, 491
- reticulosperma 474, 491
- verrucispora 474, 491

Guignardia
  musae 239
Gymnopus
  radicata 382
Gyoerffyella 445
  oxalidis 443, 446
  rotula 443

Hamatocanthoscypha 14
Haplographium 9, 20, 21
  catenuatum 19-21
  delicatum 19
Haplotheciella 185
Hebeloma 301, 303, 304
 sect. Denudata 302, 303, 316
 sect. Hebeloma 302, 303
 subsect. Crustuliniformia 302
 subsect. Hiemalia 317
 subsect. Mesophaea 303, 304
 subsect. Sacchariolentia 310
 subsect. Sinapizantia 317
  angustifolium 301-303
  crustuliniforme 302, 304, 306
  fastibile 301-307
  firmum 316
  latifolium 310
  mesophaeum 306
  pallidoluctuosum 310
  sacchariolens 310
   var. **pallidoluctuosum** 301, **309**, 310
   var. sacchariolens 310
   var. tomentosum 310
  smithii 301, **303**
  sordidum 301, 303-306, 309
  tenuifolium 301-303
  testaceum 304
  theobrominum 301, **311**, 312, 314-317
  truncatum 316, 317
Heliscella
  stellata 443
Heliscina
  campanulata 443
Heliscus 445
  lugdunensis 443
Helminthosporium
  arctesporum 127, 128
Hemitrichia
  calyculata 197
  minor 200
Hericium 207
Huilia 74
Humaria 424
  persoonii 477
   var. amethystina 483
Hyalopeziza
  corticicola 11
  valesiaca 11
Hyaloscypha 10, 11, 20
  olivacea 9, 19, 21, 23, 24
  priapi
   var. obsoleta 14
  stevensonii 12
Hyphodontia 207
Hypoxylon 287
  nummularium 210
  operculatum 210, 213
  serpens 213
  stigma 213

Ingoldia
  biappendiculata 443
Inocybe 110, 111
Iodophanus 424
Isthmotricladia 443, 449

Jafnea 424
Jafneadelphus 474

Kuehneromyces 104

Lachnum 10
Lactarius 157, 158, 175
 subg. Plinthogalus 166
  argillaceifolius 157, 158, 160
  camphoratus 158
  chrysorheus 158
  deceptivus 158
  deliciosus 158
  fuliginellus 157, 160, 161
  fuliginosus 158, 162, 163
  fumosus 157, 162, 164
  gerardii 157, 163, 164
  hygrophoroides 169-171
  indigo 158
  insulsus 158, 169
  lignyotellus 157, 165, 167
  maculatus 159
  olympianus 157, 167-169
  piperatus 158, 173
   var. glaucescens 157, 172-174
  pterosporus 157, 170-172
  rufus 158
  salmonicolor 158
  sanguifluus 158
  scrobiculatus 158
  speciosus 157, 173, 174
  subdulcis 158
  texensis 157, 165, 166, 168
  vellereus 158
  veracrusis 158
  volemus 158
  yazooensis 169

zonarius 169
Lamprospora 475
  georgii 473, 482
  jetelae 473, 479, 481, 482
Lasiosordaria 415
Lasiosphaeria 283, 285, 415
  ambigua 412
  breviseta 285, 287
  caudata 285, 287
  chrysentera 269, 275, 277, 279, 281
  foliicola 269, **281**, 283, 285
  hirsuta 274
  hispida 274
  meznaensis 285, 287
  multiseptata 274
  munkii 269, **285**, 287
  ovina 279, 281, 412
    var. aureliana 279, 281
  phyllophila 283, 285
  sorbina 281
  subambigua 407, 408, 411
Lateriramulosa
  uni-inflata 443
Lecania
  cyrtella 69, 72
Lecanora
  bicincta 75
  chloroleprosa 72
  geophila 71, 76
  pachythallina 71, 76
  rupicola 75
Lecidea 74
  geophana 75
  ileiformis 69, 73, 78
Lemkea 350
  sphaerospora 350
Lemonniera
  aquatica 443
  terrestris 443
Lempholemma 73
  myriococcum 73, 78
  radiatum 73
Leptocladia
  neglecta 443
Leptographium 149, 504
  wageneri 501, 502, 504
    var. **ponderosum** 501, 502, **505**, 507
    var. **pseudotsugae** 501-503, **505**-507
    var. wageneri 501-507
Leptosphaeria
  obtusispora 185
Leuconeurospora
  elongata 7
Leucoscypha 424
Licea
  denudescens 200
  erectoides 200
  kleistobolus 200
  operculata 200
  parasitica 195
  pedicellata 200
  scyphoides 200
  testudinacea 195
Lopadium
  fecundum 75
  sociale 75
Lunulospora
  curvula 443

Macrophoma 118, 124
Marcelleina 473-476, 483, 486, 487, 490-492, 498
  amethystina 484
  atroviolacea 478, 490
  benkertii 473, 474, 476, 477, **487**, 488, 491, 499
  brevicostatispora 473, 476, 477, 481, 484, 492, 497
  donadinii 473, 474, 476, 477, 489, **490**, 491, 498
  georgii 473, 476, 477, 481, **482**-484, 492, 496
  persoonii 473, 475-480, 482-484, 492, 494
  planchonis 487, 488
  pseudoanthracina 473, 475, 476, **484**-486, 498
  rickii 473, 476, 478, 479, 481-483, 486, 492, 495
Margaritispora
  aquatica 443
Massaria 289, 291, 296
  bufonia 291, 292
  curreii 291
  heterospora 290
Massariella 289, 290, 292, 294, 296, 297
  acerina 290
  berberidicola 289
  bufonia 289, 291, 292
  curreyi 289, 292
  eriophori 290
  lovereana 290
  monthae 289, 292
  oleae 290
  trevoae 289, 292
  vibratilis 289, 292
  yerbae 289, 292
Massarina 451
Melanolecia 74
  transitoria 69, 74
Melastiza 424, 426
Microsphaeropsis 178, 185

- concentrica 177, 178, 180, 182, 184-186
- conielloides 185
- olivacea 178, 184-186
- pseudaspera 185
- sarcinellae 186

Mollisina 11
Monoplodia 178
Monotosporella
  - tuberculata 443

Morchella 428
Mycocentrospora
  - acerina 443

Myelochroa 339

Naucoria
  - kauffmannii 228

Nectria 153
Neofuscelia 327
Neurospora 7

Ochrolechia
  - frigida 73

Octospora 424
Ophiostoma
  - wageneri 505, 507

Ordus 448
Oudemansiella 104, 357, 358, 374, 390, 402, 403
  - sect. Radicatae 357
  - canarii 390, 402
  - longipes 390
    - var. americana 390
  - mucida 390, 402
  - radicata 358, 383
    - var. americana 390
    - var. furfuracea 374
    - f. rubescens 383

Parachnopeziza 13
Paradiacheopsis
  - cribrata 200

Paraphaeosphaeria 184
  - castagnei 184
  - glauco-punctata 185
  - michotii 184
  - obtusispora 185

Parmelia
  - adpressa
    - var. stenophylloides 330
  - conspersa
    - var. subdiffluens 330
    - f. parvula 330
  - eximia 320
  - laxa
    - var.subdiffluens 330
    - f. parvula 330
  - neopropagulifera 324
  - potaninii 322
  - propagulifera 324
  - stenophylloides 330
    - var. propagulifera 324
  - subdiffluens 330
  - xanthomelaena 334
  - xanthomelana 334

Parmelina 339
Parmelinella 339
Parmelinopsis 339, 341
  - **bonariensis** 339, **341**-343
  - damaziana 343
  - neodamaziana 343

Parmotremopsis 339
Peltigera 75
Perichaena
  - chrysosperma 200

Periconia 346, 348, 350
  - hispidula 350
  - lateralis 350

Peronospora 133-135, 143-147
  - alsinearum 146
  - alta 147
  - conferta 133-136, 139-145
  - **fontana** 133, 137, 139-142, 146, **147**
  - lepidii 147
  - parasitica 146, 147
  - paula 133-135, 138-146
  - plantaginis 147

Pertusaria, 74
  - atra 69, 74, 78
  - bryontha 74

Peyronellaea 239, 240
  - circinata 240, 242, 244, 246
  - musae 239, 242
  - nainensis 239, 240, 242, 244, 246
  - nigricans 240, 242, 244, 246
  - ruptilis 240
  - sibirica 240
  - stemphylioides 240
  - zhdanovii 240

Peziza 486
  - anthracina 486
  - atroviolacea 478, 490
  - dematiicola 9, 19, 24, 25
  - lobata 491
  - pseudoanthracina 484
  - verruculosa 491-492
  - violascens 490

Phaeocollybia 221-223
  - sect. Phaeocollybia 227
  - attenuata 223
    - subsp. attenuata 221, 224, 225, 234
    - subsp. mexicana 222, 225
  - californica 221, 223, 225, 226, 230, 234

- christinae 221, 223, 226, 227, 232, 234
- jennyae 227
- kauffmanii 221-224, 227, 228, 232, 234
- laterarius 226, 227
- lugubris 221-223, 229, 230, 234
- mexicana 221-223, 230, 231, 234
- neosimilis 225
- rufipes 227
- scatesiae 226
- sipei 226
- spadicea 229, 230
- spoliata 221, 223, 230, 231, 234

Phaeorrhiza
- nimbosa 74
- sareptana 75
  - var. sphaerocarpa 69, 74, 78

Phialocephala 149, 150, 153
- dimorphospora 150
- canadensis 150
- fluminis 151
- fortini 151
- fusca 151
- humicola 151
- illini 149, 151, 153, 154
- mexicana 151
- phycomyces 151
- repens 151
- xalapensis 151

Phillipsia 426

Pholiota 104

Phoma 184, 239, 244
- agaves 184
- americana 239
- concentrica 178, 180
- diplodiella 177
- glomerata 239, 240, 244, 246
- herbarum 239
- jolyana 239-242, 244-246
  - var. circinata 240, 242, 244
  - var. jolyana 240
- jolyi 240, 242
- musae 239, 242, 244
- nainense 240
- nainensis 240
- pomorum 184, 239, 240, 244
- sorghina 239, 240

Phorcys 289

Phylliscum
- demangeonii 72

Phyllosticta
- musarum 239

Phyllostictella 178

Physarella
- oblonga 197
  - f. alba 197

Physarum
- bethelii 200
- decipiens 200
- flavicomum 197
- melleum 197
- nutans 197, 200
- oblatum 200
- sessile 200
- stellatum 197
- tenerum 197
- viride 197

Physconia
- muscigena 74

Physma
- polyanthes 73

Pithomyces 29, 30, 36
- africanus 29, 32
- chartarum 29, 36
- **clavisporus** 29, **30**-32
- cynodontis 29
- funiculosa 30, 32, 34
- funiculosus 30, 32
- graminicola 29, 30, 32-34, 36, 37
- karoo 36
- maydicus 29
- pavgii 29, 30, 32, 34, 37
- sacchari 29, 30, 36

Placodium
- stapfianum 70

Placynthium
- aspratile 72

Pleospora
- centrum 297

Pleurage
- albicans 411

Plicaria
- anthracina 484, 486
- persoonii 477

Podospora 415

Poikiloderma 289, 290, 294, 296
- bufonium 289, 294

Protounguicularia 9, 10, 12, 14
- barbata 11
- brevicapitata 11
- monoseptata 10-13, 16, 18
- variepilosa 10-15, 18

Pseudaleuria **419**, 424-426, 428
- **quinaultiana** 417-**419**, 421, 422, 424-428

Pseudephebe
- minuscula 72

Pseudoparmelia 334
- xanthomelaena 334

Pseudoplectania 424
- nigrella 422

Psilocistella 14
- conincola 14

  - lignatilis 14
  - quercina 14
  - vernalis 14
- Pteridiospora 289, 290, 294
  - javanica 294
- Pulparia 473-475, 486
  - amethystina 479, 482, 483
  - arctica 473, 490
  - jetelae 473, 479
  - rickii 479
- Pyronema 428, 429
- Pyxidiophora 2
  - kimbroughii 2

- Rhizocarpon
  - bryonthae 74
- Rhodocybe
  - truncata 316
- Rimularia
  - insularis 75
- Rinodina
  - nimbosa
    - var. sphaerocarpa 74
- Rutola
  - graminis 346

- Sarcoscypha 424
  - coccinea 422
- Schadonia
  - alpina 75
  - fecunda 75
- Sclerocystis
  - rubiformis 260
- Scutellinia 424, 482
- Septomyxa 118
  - aesculi 118
- Smardaea 473-475
- Sowerbyella 491
- Speira
  - stipitata 351
- Speiropsis
  - irregularis 447
- Sphaeria 211, 290
  - bufonia 291, 292, 294
  - cinerea 212
  - corniformis 82, 83
  - decorticans 211, 214, 218
  - decorticata 210-212, 215, 216
  - dissepta 213
  - episphaeria 218
  - macula 212, 213
  - nummularia 212
  - stigma 210, 211, 213, 214, 216, 218
    - var. decorticata 211, 212, 215, 216, 218
    - var. quadricocca 212, 217
    - var. stigma 211
    - (rank ?) α 210
    - (rank ?) β 211, 218
    - (rank ?) β decorticans 211, 214
    - (rank ?) β decorticata 210, 215
  - subaffixa 218
  - undulata 212, 217, 218
- Sphaeropsis 291
  - conica 291
  - musarum 239
- Sphaerosoma 474, 475, 486
- Sphaerosporella 424
- Sporidesmium
  - bakeri 29
    - var. I 30
  - goidanichii 351
  - sacchari 37
- Sporodum 350
  - conopleoides 350
  - effusum 348
- Steinia
  - geophana 69, 75, 76
- Stemonitis
  - smithii 197
  - splendens 197
- Stemonitopsis
  - amoena 195
  - typhina 197
- Stictosphaeria
  - hoffmannii 213, 214, 216
  - undulata 217
- Stromatosphaeria 212
  - decorticata 216
  - stigma 213
  - undulata 217
- Subulispora 266, 459
  - **argentina** 263, **264**, 266
  - **longirostrata 459**, 460, 463
  - procurvata 266, 459, 460, 463
  - rectilineata 266, 459
- Suillus
  - luteus 104

- Taeniospora 446
  - gracilis 443
- Tetrachaetum
  - elegans 443
- Tetracladium
  - furcatum 443
  - marchalianum 443
  - maxilliforme 443
  - setigerum 443
- Tetraploa
  - **abortiva** 263, 264, **266**
- Thaxteriola 1, 2
  - **acarinophila 1**, 2

  infuscata 2
  moseri 2
Thrombium
  epigaeum 69, 76
Toninia
  caeruleonigricans 73
Torula 345
  graminis 346
Tremolecia 74
Tricellula 447
  aquatica 443
  botryosa 443
Tricharina 424, 426
  fribrillosa 422, 424, 426
Trichia
  erecta 195
Trichobotrys 345, 348, 350
  effusa 345, 348-350
  pannosa 345, 348
Trichocladium 30
  pavgii 30, 32
Tricholoma 104
Tricladium 446
  angulatum 443
  caudatum 443, 446
  curvisporum 443
  gracile 444
  splendens 444
Tripospermum
  camelopardus 444
  myrti 444
Triposporium 351
  bicorne 351
Triscelophorus 444, 445
Tuber 258

Urceolella
  carestiana 11
  richonis 9, 19, 20, 22-24
Uromyces 193
  hyderabadensis **193**, 194
  scarabaeoidis 194
Usnea 39, 60
  barbata
    var. rubiginea 40, 50
  endochrysea 39, 42, 60, 62, 64
  evansii 39, 42, 50, 56, 60, 62, 64
  florida 39, 40, 42, 60, 64, 66
    var. intermedia 39, 42, 44, 54
    var. major 39, 42, 44
    var. rubiginea 39, 40, 50
    var. strigosa 39, 40
  intermedia 44
  michauxii 39, 44, 50, **54**, 56, 60, 62, 66
  rigida 66
  rubicunda 40
  rubiginea 40, 50
  strigosa 39, 40, 42, 56, 64, 66
    subsp. **major** 39, 40, 42, **44**, 48, 50, 54, 60, 64
    subsp. **rubiginea** 39, 42, 48, **50**, 54, 56, 60, 64
    subsp. strigosa 42, 44, 48, 50, 60, 64
  subfusca 60
  tristis 39, 42, 56, 60, 62, 64, 66

Valsa
  scabrosa 212
Varicosporium
  elodeae 444
Verrucaria
  epigaea 76
Verticicladiella 149, 504
  wageneri 501
    var. ponderosa 501, 504, 505
    var. wageneri 504
Volucrispora
  graminea 444
  ornithomorpha 444

Wynnea 428, 465, 469, 470
  americana 467, 470
  gigantea 469, 470
  macrospora **465**, 466, 469, 470
  macrotis 469, 470
  sinensis 465, **467**-470
  sparassoides 467, 470

Xanthoparmelia 319, 321, 323, 325, 327-329, 331, 333
  affinis **319**, 321
  applicata 319, **320**, 321
  austroamericana 320
  austrocapensis 319, **320**, 321
  brevilobata 324
  brunnthaleri 320
  chlorochroa 324, 326
  competita 319, 320
  congensis 327
  constrictans 319
  convoluta 324
  cordilleriana 332
  cumberlandia 334
  diacida 328
  dierythra 327
  dubitata 327
  duplicata 319, 322, 326
  durietzii 319, 321, **322**
  gyrophorica 328
  kurokawae 328
  mbabanensis 319, **322**, 323
  metamorphosa 332
  microlobulata 319, **322**, 323

- **naudesnekia** 319, 323, **324**
- **neochlorochroa** 319, 323, **324**
- **neopropagulifera** 319, **324**, 325
- **neotumidosa** 319, 322, 325, **326**
- **norchlorochroa** 319, 325, **326**
- norconvoluta 324
- **norhypopsila** 319, 325, **326**
- **obscurata** 319, **327**, 329
- plittii 326, 332
- praegnans 332
- **pseudocongensis** 319, **327**, 329, 330
- **psoromica** 319, **327**, 329
- **putsoa** 319, **328**, 329
- **rugulosa** 319, **328**, 331
- schenckiana 328
- simulans 320
- somloensis 322, 330
- **stenophylloides** 319, **330**, 331
- **subdiffluens** 319, **330**, 331
- **subplittii** 319, **330**, 331
- subramigera 322
- **subsorediata** 319, **332**, 333
- tegata 334
- **tenacea** 319, **332**, 333
- **tenuiloba** 319, **332**, 333
- **tolucensis** 319, 333, **334**
- tucsonensis 330
- tumidosa 326
- worcesteri 320
- **xanthomelaena** 319, **334**

Xeromedulla **189**, 192
- **leptospora** 189, **190**-192
- **tomentulosa** 189, **190**, 191

Xerula 357, 358, 360, 402, 403
- sect. Radicatae 357, 360, 383, 389, 402
- sect. Xerula 360, 402
- americana 360, 390, 392
- caussei 402
- **furfuracea** 357, 358, 360, **362**, 364, 366-370, 372, 374, 382, 383, 386, 392, 398, 400-403
- kuehneri 403
- longipes 402
- **megalospora** 357, 358, 360, 362, 372, **374**, 375, 377-383, 392, 398-403
- radicata 357, 358, 360, 374, 382, 383, 402, 403
  - var. africana 357, 360, 362, 392, 397, 398
  - var. **bispora** 357, 362, 367, 370, **398**
  - var. furfuracea 360
  - var. radicata 357, 360, 362, 374, 382, 389, 392, 397, 398, 402
  - f. marginata 392
- **rubrobrunnescens** 357, 358, 360, 362, **384**, 386-389, 392, 403
- **rugosoceps** 357, 360, 362, **386**, 389, 390, 392, 394-398

Xylaria 81, 82
- alpina 82
- castorea 81
- corniformis 81-85
- curta 81, 82, 84
- feejeensis
  - subsp. faveolis 82
- longipes 81, 84
  - var. microspora 81
- polymorpha 81, 82

Xylohypha
- lignicola 346, 348

Xylosphaera 82

REVIEWERS, VOLUME TWENTY-NINE

The Co-Editors express their appreciation to the following individuals who have, prior to acceptance for publication, reviewed one or more of the papers appearing in this volume.

J. A. von Arx
M. E. Barr Bigelow
G. F. Bills
J. Bissett
M. Blackwell
A. Bolay
S. von Broembsen
O. Constantinescu
H. V. Cotter
J. L. Crane
G. B. Cummins
V. Demoulin
W. C. Denison
R. S. Egan
R. L. Gilbertson
J. H. Ginns
D. A. Glawe
R. D. Goos
J. H. Haines
M. E. Hale
L. Holm
S. J. Hughes
I. Kärnefelt
B. Kendrick
J. W. Kimbrough
H. Knudsen
Th. W. Kuyper
E. S. Luttrell
D. Malloch
L. Maranová
C. W. Mims
E. Mueller
T. H. Nicolson
M. E. Palm
D. H. Pfister
Z. Pouzar
S. A. Redhead
R. G. Roberts
J. D. Rogers
A. Y. Rossman
G. J. Samuels
B. M. Spooner
B. C. Sutton
M. R. Tansey
J. W. Thompson
R. Watling
J. Webster
A. J. S. Whalley
M. J. Wingfield
Jorge C. Wright
P. J. Zambino

MYCOTAXON PUBLICATION DATE

Volume **29** (July-September 1987) July 31, 1987

ERRATA, VOLUME TWENTY-EIGHT

Page 2 line 44 *for* Psilopeziza *read* Psilopezia

ERRATA, VOLUME TWENTY-NINE

Page 301 lines 14-15 *for* Filobasidiella arachnophila (Malloch et al., 1978),
read Filobasidiella depauperata (Samson et al., 1983),
302 lines 10-11 *for* arachnophila Malloch, Kane, & Lahaie
read depauperata (Petch) Samson, Stalpers, & Weijman
303 line 26 *for* arachnophila *read* depauperata
305 21 *add reference:*
Samson, R.A., J.A. Stalpers, and A.C.M. Weijman. 1983. On the taxonomy of the entomogenous fungus Filobasidiella arachnophila. Antonie van Leeuwenhoek 49:447-456.
451 line 3 *for* LORI. M. CARRIS and DEAN. A. GLAWE
read LORI M. CARRIS and DEAN A. GLAWE

ERRATA, VOLUME THIRTY

Page 130 line 7 *for* C. arctespora *read* Corynespora arctespora
151 1 *for* P. flumninis *read* P. fluminis
474 22 *for* G. mulerii *read* G. muelleri

[CONTENTS continued from inside front cover]

Author INDEX 515
INDEX to Fungous and Lichen Taxa 519
Reviewers 530
Publication date, MYCOTAXON Volume 29 530
Errata 531

[MYCOTAXON for July-September 1987 (**29:** 1-522) was issued July 31, 1987]

CO-EDITORS OF MYCOTAXON

G. L. HENNEBERT
FRENCH LANGUAGE EDITOR
& BOOK REVIEW EDITOR

UCL, Place Croix du Sud 3
B-1348 Louvain-la-Neuve, Belgium

RICHARD P. KORF
ENGLISH LANGUAGE EDITOR
& MANAGING EDITOR

P.O. Box 264
Ithaca, NY 14851, USA

MYCOTAXON is a quarterly journal devoted to all phases of mycological and lichenological taxonomy and nomenclature. It seeks to publish all papers within 5 months of submission, using photo-offset lithography. All articles are reviewed by specialists prior to acceptance. Publication is open to all persons. Papers may be in French or English, with one or more summaries in any language.

SUBSCRIPTION INFORMATION

Each issue of MYCOTAXON varies in number of pages. Each volume, beginning with volume 3, contains at least 512 pages, and consists of an irregular number of quarterly issues. Subscriptions are on a *per volume* basis, *not* on an annual basis. If only one billing during each year is a requirement, please pay for 2 or 3 volumes which will normally cover one year's issues; when more volumes are published in one year than have been paid for, the following year's invoice will include the unpaid volume. Personal subscriptions are available at a substantially reduced rate for *individuals* who agree not to deposit their copies in another library than their personal one within 3 years of receipt. All back volumes are still available. Prices for each volume are:

REGULAR (multiuser)	$48.00 US
PERSONAL (individual)	$21.00 US

(*Complete runs*, volumes 1 through the latest complete volume, are subject to a **20% discount** for new subscribers; old subscribers who wish to *complete* their set may purchase missing volumes at the 20% discount.)

MYCOTAXON may also be obtained on a journal-exchange basis. This may be arranged with journals, institutions, or individuals who have difficulty in obtaining foreign currencies. For details, write a Co-Editor.

TWENTY-VOLUME CUMULATIVE INDEX, 1974-1984

MYCOTAXON CUMULATIVE INDEX FOR VOLUMES I-XX (1974-1984) by Richard P. Korf & Susan C. Gruff (ISBN 0-930845-00-5) is available at $17.50 *postpaid* from MYCOTAXON, LTD., P.O. Box 264, Ithaca, NY 14851-0264 USA.

AVAILABILITY IN MICROFORM, & TEAR SHEET SERVICES FOR ARTICLES

MYCOTAXON is also available in *microfiche* and in *microfilm* from University Microfilms, 300 North Zeeb Road, Ann Arbor, MI 48106 USA or 30-32 Mortimer Street, London W1N 7RA, England, from whom prices may be obtained.

Tear sheets of individual articles appearing in MYCOTAXON may be obtained through OATS, Institute for Scientific Information, 3501 Market Street, Philadelphia, PA 19104 USA, from whom prices may be obtained.

EDITORIAL SERVICES & INFORMATION FOR PROSPECTIVE AUTHORS

Authors prepare their own *camera-ready* copy after having received comments from pre-submission reviewers. Detailed *Revised Instructions to Authors* appeared in MYCOTAXON **26**: 497-510 (1986). A copy of these instructions will be sent upon request to one of the Co-Editors.

We are able to provide prospective authors with two aids to publication. Both are sold at our cost, and may be ordered from MYCOTAXON, LTD., P.O. Box 264, Ithaca, NY 14851-0264 USA.

SPECIAL MANUSCRIPT PAPER is available in pads of 50 sheets, and is ruled in blue, non-photoreproducing ink for both sizes of typeface (pica and elite) called for in the instructions to authors, and for non-reduction copy. It is a convenience to typists, but certainly not essential, since rectangles of the appropriate size can be prepared on any paper using a non-photoreproducing blue pencil. Each pad of 50 sheets is shipped by *postpaid* surface mail for $2.50.

BIOPLATE is a special sheet of transfer letters designed by the Managing Editor for use in the preparation of plates and graphs for publication. It is manufactured for us by Prestype, is approximately 30 × 39 cm, with a wide assortment of numbers, letters (including important Greek characters), symbols, arrows, etc. Currently available only in black, sheets are shipped by *postpaid* surface mail for $4.95.